

The Milbank Memorial Fund
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IN THIS ISSUE

NEW diagnostic criteria and special techniques for appraising nutritional status are furnishing the means for answering the questions "How prevalent are deficiency states among various population groups and what is the nature of these deficiency states?" The results of special examinations for nutritional status on nearly 1,200 industrial workers are presented and discussed by Henry Borsook, Elmer Alpert, and Geoffrey L. Keighley in a report entitled "Nutritional Status of Aircraft Workers in Southern California, Clinical and Laboratory Findings." Since these were presumably healthy men at work, no cases of frank acute deficiency diseases were expected and none were found. On the other hand, all those examined showed either clinical signs or laboratory evidence of mild to moderately severe deficiency, usually chronic, of one or more nutrients. The prevalence of specific deficiencies varied greatly and was affected by the great variation in sensitivity of the criteria applied for diagnosing mild deficiencies. Thus, 2 per cent of the group gave clinical evidence of severe niacin deficiency; 11 per cent had hemoglobin values indicative of mild anemia; 32 per cent had plasma ascorbic acid concentration below 0.4 mg. per cent; 9 per cent showed facial dermatitic signs of riboflavin deficiency but nearly every person had some degree of corneal vascularity associated with riboflavin deficiency; and, by the criterion of conjunctival thickening or opacity for vitamin A deficiency, 50 per cent of the men had grossly visible localized conjunctival elevation and the remainder showed some degree of opacity or translucency on biomicroscopic examination. These findings corroborate evidence from dietary studies that few persons consistently eat a diet which furnishes entirely adequate amounts of all essential nutrients.

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The rising cost of food during the past two years has affected all families in the United States. In the article "Recent Changes in Income and

Food Expenditures Among Tuberculous Families in Harlem," by Jean Downes, present level of income and food expenditures in a group of families are described and compared with income and food expenditure in 1940. The purpose of the investigation was to learn whether income in the families had increased on the average in proportion to the known increase in the cost of food. Since tuberculous families constitute a population in most imminent danger of contracting the disease, their level of living in relation to changes in the cost of living should be a matter of concern to those interested in the control of tuberculosis.

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Because of the relationship between nutritional status and general resistance to infection, improvement in the diets of families exposed to infectious tuberculosis has been one of the points of emphasis in an experimental program for control of the disease among Negroes. In the article "A Study of Food Habits of Tuberculous Families in a Harlem Area of New York City," by Jean Downes, the quality of the diets is described and the changes in quality brought about through the teaching of the public health nurse are evaluated. Less than 10 per cent of the families studied had dietary patterns corresponding to a recommended standard. However, it was demonstrated that improvement in food habits can be obtained in families where sufficient emphasis is placed upon teaching what constitutes a good diet.

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The lack of satisfactory data and the complexities of the problem have deterred attempts at constructing life tables for populations classified by socio-economic characteristics. Dr. Christopher Tietze has made a contribution in this field in his article "Life Tables for Social Classes in England." His basic data consisted of mortality rates of occupied and retired males, sixteen years of age and over, by age and occupational class. These materials were available from British official statistics for the triennium 1930-1932. For younger ages, the occupational class of the father was used as the basis for classification. Mortality rates for males under two years of age were available by occupational class of the father. The occupational differentials at ages 2-15 were estimated by assuming that the mortality rate for each occupational class deviated in a given direction and degree from the known rate for all males at the age con-

sidered. Despite the limitations of the data, the author's final results on class differences in survival rates and expectation of life appear to be reasonable.

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There is today an acute shortage of adequately trained nursing personnel. When the needs of the armed forces are satisfied, the remaining nurses can meet urgent civilian needs only if their services are distributed among the various elements of the population on the basis of need for care. The article "Variation in Nursing Service With Family Income and Size of City," by Selwyn D. Collins, presents data on the frequency of illness and nursing care in 8,758 white families in 130 localities in eighteen states. Nursing of any kind (private duty or visiting nurse) showed greater frequency in high and low-income groups than in the middle-income levels. Morbidity data should form the basis for planning a wise distribution of nursing service to meet civilian needs and this article provides factual information which is of present value.

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NUTRITIONAL STATUS OF AIRCRAFT WORKERS IN SOUTHERN CALIFORNIA¹

II. CLINICAL AND LABORATORY FINDINGS

HENRY BORSOOK,² ELMER ALPERT,² AND GEOFFREY L. KEIGHLEY²

MOST workers in the United States are not obtaining adequate diets. Stiebeling and Phipard (1) examined the diets of families of employed (nonrelief) workers in four great geographical regions—North Atlantic, East North Central, East South Central, and Pacific—in the years 1934-1937. In the Pacific region on the average, 14 per cent of the family diets were "good," 46 per cent were "fair," and 40 per cent were "poor." In the three other regions the percentage of "poor" diets was even higher.

¹ This study is sponsored jointly by the Nutrition Committee (R. A. Millikan, Chairman) appointed by the Board of Supervisors of the County of Los Angeles, California, and the Committee on Nutrition in Industry of the National Research Council.

The studies reported in the present communication were supported by the sponsors, The California Fruit Growers Exchange, The California Institute of Technology, The Lockheed Aircraft Corporation, the Milbank Memorial Fund, and the Work Projects Administration (Project Number 12373).

This survey is under the direction of one of us (H. B.). We were assisted in the organization of the examination procedure by Miss D. G. Wiehl and Dr. H. D. Kruse of the Milbank Memorial Fund. The forms on which the data were collected were drawn up by Miss Wiehl. We are indebted to Miss Wiehl also for the tabulation of a part of the data reported here, and for her thorough and valuable criticism of the manuscript of this paper. Dr. Kruse instructed us in the use of the biomicroscope; his method of recording the biomicroscopic examinations was employed.

The physical examination and medical history procedures were worked out by Dr. Robert Goodhart and Dr. Elmer Alpert. Dr. E. D. Kremers participated in the physical examinations.

All the examinations including the laboratory determinations were carried out at the plant of the Lockheed Aircraft Corporation at Burbank, California.

We wish to thank Dr. F. E. Poole and Dr. Seymour Dudley of the Lockheed Aircraft Corporation for their friendly cooperation and assistance in this work. In addition to the above mentioned and the authors, the following participated in the collection and tabulation of the data: J. R. Cook, J. W. Dubnoff, H. L. Edwards, E. B. Goolden, L. O. Hemenway, E. E. McFarland, G. H. Palmer, J. E. Piazza, M. M. Rush, B. T. Waterbury, M. A. Way, and J. G. Williams.

² California Institute of Technology, Pasadena.

³ Milbank Memorial Fund.

The basis for their classification of "good," "fair," and "poor" diets is given in Table 1.

The standards for vitamins B₁ and B₂, used by Stiebeling and Phipard, are lower than the allowances recommended by the Committee on Food and Nutrition of the National Research Council (2). If the latter standards had been used, the "good" diets in the Stiebeling and Phipard survey would have been much less than 26 per cent and the "poor" diets much greater than 50 per cent.

The Committee on Nutrition in Industry of the National Research Council has pointed to the abundance of other evidence from which the same conclusion must be drawn—that the diets of our workers are not as good as they should or can be (3).

One study may be cited (4), that in Pasadena between May and August, 1938, which was in the same region as the present survey. It was found that the intake of calories and protein was adequate in all families of employed workers; but the intake of calcium and

Table 1. Comparison of the basis of classification of diets used by Stiebeling and Phipard and daily allowances recommended by the Committee on Food and Nutrition of the National Research Council.

NUTRIENT	STANDARDS FOR "GOOD" AND "POOR" DIETS ¹ USED BY STIEBELING AND PHIPARD ²		DAILY ALLOWANCES ¹ RECOMMENDED BY COMMITTEE ON FOOD AND NUTRITION, NATIONAL RESEARCH COUNCIL (2)
	Quantities in Uncooked Food		
	"Good"	"Poor"	
Protein, Gm.	67	45	70
Calcium, Mg.	680	450	800
Iron, Mg.	15	10	12
Vitamin A, I.U.	6,000	3,000	5,000
Vitamin B ₁ , Mcg. ³	1,500	750	1,800
Vitamin B ₂ , Mcg. ⁴	1,800	900	2,700
Vitamin C, Mg.	75	37	75

¹ For a moderately active man weighing 70 kg.

² Diets that were better in every respect than the specifications for "poor" diets, but poorer in one or more specific nutrients than the specifications for "good," were classed as "fair."

³ 1 I.U. taken as equal to 3 mcg.

⁴ 1 Sherman Unit taken as equal to 3 mcg.

vitamins A and B was inadequate in more than one-third of the families studied. There is one important dietary difference between the 1938 group and the present one. In 1938 even the poorest families obtained 70 mg. or more of vitamin C per "consumption unit"; in 74 per cent of the families leafy vegetables contributed more vitamin C than citrus fruits. In the present survey over 40 per cent obtained unsatisfactory amounts of vitamin C (5). It is unlikely that the difference in vitamin C intake between 1938 and 1940-1941 can be ascribed to the difference in season of the two surveys—May through August in 1938 as against November through February in the present survey, because citrus fruit and fresh leafy vegetables are readily available throughout the year in this region.

The inadequate diets of our defense workers affect their health and productivity (3). The studies of Williams, *et al.*, (6) have shown that a thiamin intake as low as that of many of our workers may be responsible for such common symptoms as undue fatigue, soreness of muscles, backache, loss of interest in work, and depressed mental states.

A few employers in this country are already convinced that the productive capacity of their workers can be improved by improving their nutrition. In most cases, they have supplemented the diets of their workers with vitamin concentrates. It does not appear, however, that these measures have been supplemented by, on the one hand, an adequate study of the nutritional state of their workers, before and after the vitamin supplements were used, nor, on the other hand, have they attempted to ascertain precisely what has been gained by the use of the vitamin supplements.

It is of the highest importance for public health nutrition where measures such as these are taken that the results be carefully recorded and interpreted critically. In spite of all the experimental work which has been done, the influence of diet on human health (in cases where severe or acute nutritional deficiency disease is not present), on working capacity, on the incidence of accidents, and

on the psychological state needs to be demonstrated by rigorously controlled studies. There appears to be little reason to doubt that improvement in the nutrition of workers will improve their health and productivity; but the particular respects in which these benefits will manifest themselves remain to be demonstrated.

The Committee on Nutrition in Industry recommended "that adequately controlled studies be conducted in selected war or defense industries to determine the facts concerning the influence of diet and nutrition on health, working capacity, incidents of accidents, absenteeism, and the psychological state." (3)

A study among workers at the Lockheed Aircraft Corporation, Burbank, California was undertaken to meet this need. The initial examinations began in November, 1941, and ended in February, 1942.

The subjects of this survey are all white, male volunteers who came for examination on their own time (*i.e.*, without pay) between the hours of 9:00 A.M. and 2:00 P.M. Most of the subjects are plant workers on the swing shift—from 4:00 P.M. to 12:30 A.M., with one-half hour for lunch between 8:00 and 8:30 P.M. This shift was selected for the survey deliberately because it is the swing shift which has the most accidents, the most absenteeism, and the most complaints.

There were 1,173 men examined, coming from all the major departments of the plant and including some office workers and foremen. In a few cases, one or more parts of the examination had to be omitted because of lack of time. In some of the tables, data from thirty-two additional male subjects are included, whose work is supervisory or executive.

The subjects are receiving certain nutritional supplements. This will be continued for at least one year, after which all the subjects remaining in the survey will be reexamined. The nature of these supplements and their effects on health and work performance will be described in a later paper.

SCOPE OF THE EXAMINATION

A. Medical history.

B. Physical examination with special reference to evidence of nutritional disease.

C. Biomicroscopic examination of the conjunctiva and cornea.

D. Examination of the blood for syphilis, hemoglobin, cell volume, red cell count, serum albumin, and plasma ascorbic acid.

E. Diet history.

A previous paper contains an analysis of the diet histories obtained (5). A summary of the pertinent facts in the medical histories and the findings in the physical, instrumental, and blood examinations are presented here.

Some comment is called for on the methods chosen for the diagnosis of nutritional deficiency. The signs of severe malnutrition, *i.e.*, of xerophthalmia, beri-beri, cheilosis, pellagra, scurvy, anemia, and undernutrition of calories or protein, are now well established, and easily recognized by the above tests.⁴

We could not expect to find, except in very few cases, acute or severe nutritional deficiency states in a group such as that participating in this survey. The subjects are young men; they were selected, in part by a pre-employment medical examination. They live in a section of the country where the quality of the diet is, on the whole, superior to that in any other part of the country (1). It was clearly necessary, therefore, to pay special attention to the recognition of mild but chronic nutritional deficiency disease. The diseases we had specially in mind here were deficiency of vitamins A, B₁, B₂, niacin, and of C.

For the detection of vitamin A deficiency, the advisability of measuring dark adaptation was, of course, considered. The arguments against our using it were as follows: In two individuals having initially the same moderately high dark adaptation time, in one

⁴In man the signs of deficiency of such vitamins as B₆, pantothenic acid, inositol, and of choline had not yet been established.

the time is shortened after taking large doses of vitamin A, in the other, it is not. Except, therefore, when the dark adaptation time is very high, it is not possible to state, in regard to any one subject, whether or not a moderately high dark adaptation time will be reduced by vitamin A therapy, *i.e.*, whether the subject is vitamin A deficient or not. If we had used this test, we could have carried out only two determinations on each subject, one at the beginning of the survey, the other a year later. We would have obtained, therefore, only a statistical value for the group as a whole, and the interpretation of this statistical value rests on a comparison with groups who have been receiving vitamin A. Obviously this is unsatisfactory for an evaluation of nutritional status at any one time.

Furthermore, a definitely high dark adaptation time, *i.e.*, beyond the range of normal physiological variation, occurs only where the vitamin A deficiency is very marked; this deficiency may be of very short duration. Administration of vitamin A, in many cases for a short time, can reduce the dark adaptation time to the normal for that subject (7). In this survey, we were interested as much in the habitual diet and corresponding nutritional state as in recent dietary history and its consequences.

Accurate measurement of dark adaptation takes a good deal of time and repeated determinations are necessary. The men in this survey were examined in their own time, in the interval between arising and going to work. There were many tests and none could be used which took a great deal of time, or which required repetition as part of the initial examination.

Measurement of dark adaptation was therefore excluded.

Measurement of blood vitamin A was excluded because it, also, reflects only recent dietary history. The main reason for its rejection was, however, that we had not sufficient personnel to carry out this laborious and time consuming assay as quickly as would have been necessary on 1,200 subjects.

We chose to rely, therefore, mainly on biomicroscopic examina-

tion of the conjunctiva (8), supplementing this method by the findings on physical examinations. The reliability of the biomicroscopic method has been challenged (9, 10). This point is discussed below (page 127). We hope, after the reexamination of the subjects who will have received a large vitamin A supplement for a year or more, to be able to evaluate the reliability of the biomicroscopic method for the detection of vitamin A deficiency.

The same general considerations and limitations of personnel and time, which excluded blood vitamin A determinations, also excluded determination of the pyruvate tolerance test for thiamin deficiency. We have had to rely exclusively, therefore, on the findings on physical examination for evidence of thiamin deficiency, whether acute or chronic. In the course of our examinations, it was found that a large percentage of the men were unable to detect in their toes the vibration of a C-256 tuning fork. This may afford a quick test of degeneration of the nervous system possibly attributable to chronic thiamin deficiency, if the re-examination discloses any improvement in this respect.

Evidence of riboflavin deficiency fell into three categories. One category consisted of seborrheic changes in the face, fissuring at angles of the mouth, eyes, and lips, and magenta coloration of the tongue. These changes are rapidly reversible with adequate riboflavin therapy and may, therefore, be taken to indicate acute riboflavin deficiency (11).

The second category consisted of certain symptoms of ocular discomfort which are relieved by riboflavin therapy. These are described and discussed below (page 132).

A third category of evidence was obtained from biomicroscopy of the cornea. In riboflavin deficiency the cornea undergoes a characteristic vascularization; this has been described in rats (12) and in man (13). This corneal vascularity disappears with riboflavin therapy; but more slowly than the fissuring of the mouth and eyes.

As evidences of niacin deficiency we have used the well-known signs in the skin, mouth, and tongue (14).

The characteristic signs of vitamin C deficiency in the skin and gums, visible by gross examination occur only after months of nearly complete deprivation (15). Kruse has described changes in the gums, visible by biomicroscope, which he attributes to chronic vitamin C deficiency of a milder grade than complete deprivation (16). As in the case of the signs of chronic niacin deficiency in the tongue described by Kruse, these recent observations of his on vitamin C deficiency were not available at the time of our examinations. Here also we hope it may be possible to make biomicroscopic observations of the gums in the re-examinations.

The test of mild vitamin C deficiency we relied on was the plasma ascorbic acid concentration. This test suffers from the same limitation as the blood vitamin A, in that it reflects only recent dietary history. However, because it was possible to determine the plasma ascorbic acid in all the subjects examined, this was done. The utility of the test and the interpretation of the findings in large scale surveys are discussed below (page 136).

There is a great need today in the field of human nutrition of reliable, convenient tests of mild, but chronic, nutritional deficiency states. None of the tests proposed has yet found general acceptance. In the present survey we expect to be able, by re-examination, to observe on several hundred subjects the effect of nutritional supplementation for one year or more. One of the hoped for by-products of this survey is a verdict on the reliability and usefulness of some of the diagnostic tests for mild, but chronic, nutritional deficiency which have been proposed.

Dietary habits and the quality of the prevailing diet vary in different regions of the United States. They also vary with age. The economic factor, and whether a man is married and obtains most of his meals at home, or is single and eats mostly in restaurants or a boarding house often affect nutritional status. The information

summarized below under "residence," "age distribution," and "marital status" furnish some of this background information which may be useful in interpreting the observational data on nutritional status.

Residence. Of 1,177 employes the duration of whose residence in California at the time of their examination was recorded, 69 per cent had resided in California for more than a year. Of the remaining 31 per cent, the great majority came from the western states, Arizona, Iowa, Minnesota, and Nebraska supplying the largest number of these; only a few came from the East.

Age Distribution of 1,173 Employes. (Excludes 32 of unknown age and includes the executive and office personnel.)

	Per Cent
Under 20 Years	7.5
20-24 Years	38.2
25-29 Years	27.3
30-34 Years	14.7
35-39 Years	6.2
Over 40 Years	6.1

It was characteristic of the aircraft industry at the end of 1941 that most of the workers were young men. The above figures show that 73 per cent of the men examined were under 30. One year later more older men and many women were employed.

Marital Status. 44.6 per cent of 1,174 men whose marital status was recorded were single, 54.0 per cent were married, and 1.4 per cent were separated or divorced. Of the total number married, 43 per cent had no children, 30 per cent had one child, 17 per cent two children, and 10 per cent more than two children.

At the time they were examined approximately 68 per cent of the men were responsible for the support of not more than one other person besides themselves.

Incidence of Syphilis. Kahn and Kolmer tests for syphilis were done on nearly every subject. Of 1,205 men examined there were

two positive (both tests positive) and two questionable cases (one test positive, the other negative in each case).

The Company in its pre-employment examination has found positive serology for syphilis in 0.4 per cent of applicants. No man was rejected for employment solely because he bore evidence

Table 2. Ranges of height and weight found among 936 employees in the Lockheed Aircraft Corporation.

HEIGHT				WEIGHT			
Height (Inches)	Number of Subjects	Per Cent of Total Number	Cumulative Percentage	Weight (Pounds)	Number of Subjects	Per Cent of Total Number	Cumulative Percentage
TOTAL	936	99.8			936	99.9	
62 Less Than 63	1	0.1	0.1	100-109	3	0.3	0.3
63 Less Than 64	7	0.7	0.8	110-119	7	0.7	1.0
64 Less Than 65	17	1.8	2.6	120-129	55	5.9	6.9
65 Less Than 66	30	3.2	5.8	130-139	107	11.4	18.3
66 Less Than 67	71	7.6	13.4	140-149	169	18.1	36.4
67 Less Than 68	99	10.6	24.0	150-159	194	20.7	57.1
68 Less Than 69	129	13.8	37.8	160-169	138	14.7	71.8
69 Less Than 70	152	16.2	54.0	170-179	118	12.6	84.4
70 Less Than 71	145	15.5	69.5	180-189	63	6.7	91.1
71 Less Than 72	107	11.4	80.9	190-199	39	4.2	95.3
72 Less Than 73	89	9.5	90.4	200-209	23	2.5	97.8
73 Less Than 74	49	5.2	95.6	210-219	7	0.7	98.5
74 Less Than 75	23	2.5	98.1	220-229	4	0.4	98.9
75 Less Than 76	7	0.7	98.8	230-And Over	9	1.0	99.9
76 Less Than 77	5	0.5	99.3				
77 Less Than 78	4	0.4	99.7				
78 Less Than 79	1	0.1	99.8				

RELATION OF WEIGHT TO HEIGHT
(Deviation of weight from the standard (17) for height and age)

Per Cent	Per Cent of Total Number of Men
20 or More Above Standard	7.4
10 to 20 Above Standard	13.4
5 to 10 Above Standard	11.7
Less Than 5 Above or Below Standard	33.6
5 to 10 Below Standard	15.8
10 to 20 Below Standard	15.1
20 or More Below Standard	3.0

of syphilis. The low incidence of positive serology for syphilis in the group of men in the survey is not, therefore, because they were explicitly selected in this respect.

Height and Weight. The subjects were weighed in their shoes with coats or sweaters off. Table 2 summarizes the ranges of height and weight found.

Graded on the basis of standard height-weight charts (17), 33.6 per cent were in the range of ± 5 per cent of the standard weight for their height and age. 20.8 per cent weighed 10 per cent or more above the standard and 18.1 per cent weighed 10 per cent or more below the standard.

The height-weight relation of the men, as a group, is normal; 77 per cent were between 67 and 72 inches (inclusive) tall, and the weights observed fell mainly (77 per cent) between 130 to 179 pounds. The standard weight of adult men 67 to 72 inches tall is given as 146 to 168 pounds. The correspondence between the "observed" and "standard" ranges of weights is good.

The same good correspondence exists between "observed" and "standard" weights at the maximum of the distribution curves of heights and weights. There were more men, 31.7 per cent, in the height range of 69 to 70 inches (inclusive) than in any other 2-inch range. The "standard" weight for this height is 157 pounds. The observed weight range containing the largest number of men, 20.7 per cent, is 150 to 159 pounds (inclusive), which brackets the "standard" weight of 157 pounds.

EVIDENCES OF VITAMIN A DEFICIENCY OBSERVED

We have presented above our reasons for employing biomicroscopy of the conjunctiva rather than any other instrumental or laboratory method of diagnosing vitamin A deficiency.

There are several clinical signs, visible on gross inspection, which, it is believed, are indicative of vitamin A deficiency. One of these signs is follicular hyperkeratosis (18, 19, 20).

The difficulty in interpreting the significance of follicular hyperkeratosis is that on careful inspection it is observed, in varying degrees, in practically every adult person. In some there are only a few hyperkeratotic follicles; in others a large area of the skin is involved. All permutations of pigmentation, elevation, induration, infection, location, and duration are found.

Follicular hyperkeratosis is not specifically pathognomonic of vitamin A deficiency. It occurs in severe vitamin C deficiency, it can be caused by trauma.

Even granting that follicular hyperkeratosis is commonly the result of vitamin A deficiency, there are, for us, several pressing, unanswered questions. One is, are some of the hyperkeratotic changes reversible and some irreversible? An observation which prompts this question is that the incidence of this condition often appears to bear no relation to dietary history, present or past. An answer to this objection may be that the vitamin A requirement is much higher than is the general opinion. Against this explanation is the observation that even when hyperkeratotic follicles have been seen to diminish in size and number with massive vitamin A therapy, after several years of such therapy the skin has not become completely free of hyperkeratotic follicles.

Is it safe to conclude that only a few hyperkeratotic follicles do not indicate vitamin A deficiency, that only when a large area of the skin is involved is a positive diagnosis permissible? If so, where is one to draw the line? Another question: Is the area of involvement of pathognomonic significance?

We were gradually impressed with these questions, unfortunately, only after our examinations began. Having begun by recording as positive only extensive and marked follicular hyperkeratosis we were constrained to continue to do so in all cases. Seventeen persons, or 1.47 per cent of the 1,153 men receiving the physical examination, were recorded as having follicular hyperkeratosis. It is possible that in our re-examination it may be useful

to employ a more refined and extensive classification of this condition.

Another sign, easily visible on gross examination, which is attributed to vitamin A deficiency, is localized elevation of the conjunctiva, usually in the equatorial region and near the limbus (8). Among 1,172 cases, there were 552, or 47.1 per cent, with such localized elevations. There were in addition, 34 cases, or 2.9 per cent, with one or more pterygia. The total number with conjunctiva elevations visible by gross inspection was 586, or 50.0 per cent.

Kruse has described other conjunctival changes, visible by gross inspection, which he has attributed to vitamin A deficiency. These are absence of the milky blue color, pigmentation, and thickening. The two last named conditions are more easily seen with the biomicroscope and hence they were not recorded with any precision in the gross inspection.

As stated above, we have relied mainly on biomicroscopy of the conjunctiva for the diagnosis of vitamin A deficiency. One observes, in different cases and often in the same individual, varying degrees of opacity, thickening, and localized elevation.

Kruse has described the reversal of these changes when massive doses of vitamin A have been administered for an adequate length of time, which may be many months.

The above criteria and conclusions of Kruse have been challenged (9, 10). The issue needs to be clarified. Following Kruse, one must conclude that an individual who throughout his life has always ingested and absorbed an adequate⁵ amount of vitamin A would, barring injuries, have a perfectly transparent conjunctiva. Through the biomicroscope the conjunctiva would offer no translucency or opacity to obstruct vision of the fine capillary network

⁵It is understood that the amount of vitamin A which is "adequate" may vary, e.g., during a prolonged infection the need may be much greater than a good maintenance level. Habitual exposure to bright light may call for a larger amount. Imperfect absorption through the intestine, or liver disease, may necessitate the ingestion of increased amounts of vitamin A in order that an adequate amount be physiologically available.

in the sclera. When the vitamin A ingested has been inadequate for a sufficient length of time to cause thickening, opacity, or elevation of the conjunctiva, these conditions will not be cleared up by an adequate maintenance level. A mild, but prolonged suboptimal intake, will also lead to degenerative changes in the conjunctiva. Nutrition surveys have shown that the intake of vitamin A is commonly below a good maintenance level and rarely is the intake sufficient to provide against contingencies calling for a greatly increased vitamin A requirement.

It is well known that curative doses of many therapeutic agents (vitamins included) are necessarily much larger than the preventive or maintenance doses. No correlation need exist, therefore, between the presence or absence of pathognomonic conjunctival changes and the amount of vitamin A in the diet at any one time. Even though the diet may at present contain a normal maintenance amount of vitamin A, the conjunctival changes may reasonably be expected to disappear only when massive doses of vitamin A are taken for months.

Nor need there be any correlation between the condition of the conjunctiva and dark adaptation. Subnormal dark adaptation is a sign of severe vitamin A deficiency. In many subjects improvement in dark adaptation occurs in a very short time, sometimes in a few hours following the administration of a single large dose of vitamin A. This was observed by Pett and Le Page (7), and we have confirmed this observation.

This is to be expected from the physiology of vitamin A in the retina. This substance undergoes there a rapid metabolism, its combination with protein is continually being formed and broken, it is also continually being destroyed. And its rate of replenishment is obviously dependent on the amount of vitamin A in the blood stream. It is analogous, in this respect, to liver glycogen.

What is observed in the conjunctiva, on the other hand, is the end result of complex structural changes. These changes are macro-

scopic, whereas those in the retina concerned in dark adaptation are of molecular dimensions.

The conjunctival changes are the result of degenerative processes induced by long-standing vitamin A deficiency. It is reasonable to expect that massive doses are required for long periods to repair the gross structural damage of long standing, even if mild, vitamin A deficiency.

It seems to us therefore, that it is not necessarily a discrepancy that dark adaptation can be returned to normal by vitamin A therapy without any detectable change in the conjunctiva.

Table 3 contains a summary of conjunctival conditions pertinent to vitamin A deficiency observed both by gross inspection and with the biomicroscope. Graded according to severity of vitamin A deficiency, conjunctival spots represent the most severe condition, opacity without elevated spots next, and translucency which still permits the scleral vessels to be seen, the least severe deficiency.

Forty-seven per cent of our cases, as stated above, had conjunctival spots seen to be elevated by gross inspection. These spots were, of course, more conspicuous when viewed through the biomicro-

Table 3. Conjunctival conditions pertinent to vitamin A deficiency. Results of gross and biomicroscopic examination of the eyes of 1,172 employees of the Lockheed Aircraft Corporation.

CONJUNCTIVAL RATING	NUMBER OF CASES	PER CENT OF TOTAL
NUMBER EXAMINED	1,172	100
<i>Findings on Gross Examination</i>		
Pterygium, 1 or More	34	2.9
Spot—1 or More Elevated Areas	552	47.1
<i>Biomicroscopic Findings</i>		
1 or More Elevated Areas Seen Only in the Biomicroscope But Not in the Gross	374	31.9
2 to 4 Zones Opaque But Not Elevated	158	13.5
1 Zone Opaque But Not Elevated	31	2.6
2 to 4 Zones Markedly Translucent	23	2.0

scope. Another 32 per cent had spots seen as elevated only through the biomicroscope. Judged by the above criteria 79 per cent of our subjects had evidence of severe conjunctival degeneration resulting from vitamin A deficiency which was not healed by subsequent diet or therapy. In only 2 per cent were the major portions of all four conjunctival regions sufficiently translucent for the network of fine scleral vessels to be seen through the biomicroscope.

According to the above criterion every subject carried unresolved degenerative changes resulting from vitamin A deficiency, most of them of a moderate to severe character.

It must be emphasized that the reference state in this criterion is perfection. It is possible that the deepening opacity and thickening described above may not be reversible on account of their long chronicity, even though the cause was originally vitamin A deficiency. The data obtained on the re-examination of these subjects may enable us to distinguish the reversible changes.

EVIDENCES OF THIAMIN DEFICIENCY

We found no cases of acute, severe polyneuropathy or other evidence of beri-beri in any of our subjects. This was to be expected in this group.

A priori, the only evidences of thiamin deficiency we were likely to encounter would be of a chronic character. This evidence was sought in the nervous system. Our findings are summarized in Table 4.

The above signs are, of course, not specifically pathognomonic of thiamin or other nutritional deficiency. On the other hand, plantar dysesthesia is a striking sign in the peripheral neuropathy of chronic alcoholics and it disappears with adequate thiamin therapy.

Loss of vibratory sensation in the toes to a C-256 tuning fork in men under 35 is pathological; *i.e.*, it is an abnormally early degeneration. About 26 per cent of our subjects showed evidence of this premature degeneration of the nervous system. The results of the

FINDING ON PHYSICAL EXAMINATION	NUMBER OF CASES	PER CENT OF TOTAL
NUMBER OF CASES	1,153	
Absence of Ankle and Knee Jerks	3	0.3
Absence of Ankle Jerk	21	1.8
Calf Muscle Tenderness	5	0.4
Plantar Dysesthesia	170	14.7
Loss of Vibratory Sensation in Toes to C-128 Tuning Fork	9	0.8
Number of Persons With One or More of Above Signs	195	16.9
Number Examined With C-256 Tuning Fork	996	
Loss of Vibratory Sensation in Toes to C-256 Tuning Fork	256	25.7

Table 4. Evidences of thiamin deficiency observed upon examination of 1,153 employes of the Lockheed Aircraft Corporation.

re-examination may indicate to what extent impaired vibration sensation in the toes can be repaired in young adults by large vitamin supplements taken for approximately a year.

EVIDENCES OF RIBOFLAVIN DEFICIENCY

Sebrell and Butler have described (11) the signs of riboflavin deficiency on the face and tongue. They are fissures at the sides of the mouth, seborrheic (fine, scaly, greasy desquamation on a mildly erythematous base) changes at the angles of the nose and eyes and a characteristic magenta coloring of the tongue. Table 5 summarizes the incidence of the facial signs of riboflavin deficiency. The incidence of severe cheilosis, fissures at the angles of the mouth or of the lips, is seen to be quite low.

Kruse, *et al* (13) have described in detail certain ocular signs and symptoms which respond to riboflavin therapy (5 to 15 mg. daily). The most conspicuous of these are photophobia, burning of the eyes, "eye strain," conjunctivitis, circumcorneal injection, keratitis (corneal vascularization), and corneal opacity. The photophobia and burning of the eyes cleared up within forty-eight hours. The

FINDING ON PHYSICAL EXAMINATION	NUMBER OF CASES	PER CENT OF TOTAL
TOTAL EXAMINED	1,153	
Seborrhea of Cheeks, Forehead, Face, Eyelids	38	3.3
Sebaceous Plugs on Naso-labial Folds	62	5.4
Fissures of Lips	20	1.7
Fissures at Angles of Mouth	7	0.6
Number of Persons With One or More Signs	107	9.3

Table 5. Evidences of riboflavin deficiency observed upon examination of 1,153 employes of the Lockheed Aircraft Corporation.

keratitis (vascularization) also improved rapidly, but when the vascularization of the cornea was extensive, five to eighteen days elapsed before all the vessels emptied.

Among our subjects, 35 per cent complained of a burning, itchy, or gritty feeling in the eyes; 25 per cent complained of eye fatigue or eye-strain; 43 per cent stated that they were sensitive to light, that is, they were uncomfortable in bright light, and 23 per cent reported that light caused lachrymation.

The cornea was examined with the biomicroscope in every subject and the degree of corneal vascularization recorded (Table 6). Every case had some degree of corneal vascularization. "Streamer" type invasion, *i.e.*, active capillaries extending a considerable dis-

Table 6. Corneal vascularity noted on biomicroscopic examination of 1,171 employes of the Lockheed Aircraft Corporation.

EXTENT OF VASCULARIZATION (RATING BASED ON EYE SHOWING GREATER VASCULARIZATION.)	NUMBER OF CASES	PER CENT OF TOTAL
TOTAL EXAMINED	1,171	100
Streamer Type Arcades	478	42.5
3 Arcades or More, No Long Streamers	539	46.0
2 Arcades	99	8.4
1 Arcade	29	2.5
1 or 2 Arcades Without Circulating Blood	6	0.5

tance into the cornea were shown by 42.5 per cent. Another 46 per cent had three or more tiers of capillary arcades in the cornea. This was seen at the poles as well as in the equatorial regions.

No correlation was observed between such symptoms as photophobia and lachrymation and the degree of corneal vascularity. Furthermore, the diet histories showed that most of the men were getting moderate amounts of riboflavin as judged by the daily allowances recommended by the Committee on Food and Nutrition of the National Research Council. (Table 1.) This allowance, 2.7 mg. daily for a moderately active man weighing 70 kg., approximates the amount required for "saturation," *i.e.*, it is far from a minimum maintenance requirement to prevent cheilosis. On the basis of the older standard of riboflavin requirement, 1.8 mg. daily, the intake of more than half the men would have been considered satisfactory.

No correlation was found between ocular complaints, the incidence of cheilosis, and corneal vascularity. Yet by the criterion of corneal vascularity, every subject, regardless of age or economic status, must be considered as deficient in riboflavin.

Observations similar to those summarized above have been reported by Youmans *et al* (21). In a considerable number of subjects they noted mild but definite corneal vascularization not accompanied by ocular symptoms and in whom there was no correlation with dietary intake of riboflavin, other dietary factors or evidence of deficiency disease. Proceeding a step further, Youmans and Patton observed on re-examining their subjects an improvement or disappearance of vascularization in the winter or spring season compared with the fall, in spite of a lower intake of riboflavin in the former period. In the latter connection it should be noted that the observations, in the studies reported here in which practically every subject had some degree of corneal vascularity, were made in the winter season—November through February.

In the same connection Jolliffe and Goodhart (22) stated "evi-

dence is accumulating however that not all increased vascularity of the limbus and cornea is necessarily due to ariboflavinosis."

Similarly Sebrell (23) has warned "It should be noted that there is no proof that all vascularization of the cornea is due to riboflavin deficiency. Vascularization of the cornea is a non-specific symptom which may be due to a variety of causes and it is questionable whether one is justified in making a diagnosis of riboflavin deficiency on the basis of slight vascularity of the cornea as the only symptom. The subject is one which needs further investigation."

It is clearly premature, therefore, to interpret the presence of corneal vascularity in every subject examined (Table 6), as evidence of riboflavin deficiency.

The original descriptions (13) of ocular changes in riboflavin deficiency are based on findings in cases of acute riboflavin deficiency. In long standing deficiency, even of a mild character, many months of massive riboflavin therapy may be needed before the corneal vessels are occluded and free of blood. Later studies of Kruse (24) indicate that this may be the case.

It is also possible that the corneal vascularity we have observed, while it originated when the subjects were on riboflavin deficient diets, once established was not cleared up because only massive doses can effect a cure although the diets may subsequently have been good in this respect.

Granting this possibility, the question arises whether the corneal vascularity found throughout the group we have under observation can ever be cleared up by adequate riboflavin therapy, *i.e.*, whether the condition is reversible. Another version of the same question is whether some degrees and forms of corneal vascularity can be caused to disappear by riboflavin therapy and others not. The same questions arise in connection with conjunctival opacity and thickening as criteria of vitamin A deficiency.

Having raised the question of the reliability of corneal vascularity as an index of riboflavin deficiency, it must be stated that Bessey

and Wolbach (12) observed the appearance of corneal vascularity in experimental ariboflavinosis in rats (it does not occur in the guinea pig); and that Johnson and Eckardt (25) found that orally administered riboflavin, 1.5 to 3.0 mg. daily, was effective in clearing up rosacea keratitis, including the corneal vascularity.

EVIDENCES OF NIACIN DEFICIENCY

The signs and symptoms which may be associated with chronic niacin deficiency are stomatitis, glossitis, diarrhea, bilateral symmetrical dermatitis with erythema, pigmentation without erythema, and mental aberrations. The oral, gastro-intestinal, skin, and mental lesions may each occur alone or in any of the possible combinations. Vincent's infection may be superimposed on a niacin deficiency stomatitis (14).

A mild (or early form) of niacin deficiency may manifest itself as soreness of the tongue without glossitis, gastric discomfort after meals, burning of the esophagus and stomach, flatulence and constipation, and anorexia. None of these, of course, is specifically pathognomonic; but the possibility of mild niacin deficiency as the etiological factor must be borne in mind.

Little evidence of severe niacin deficiency was found in the subjects of this survey. (Table 7.)

Table 7. Possible evidences of niacin deficiency observed upon examination of 1,153 employees of the Lockheed Aircraft Corporation.

FINDING ON PHYSICAL EXAMINATION	NUMBER OF CASES	PER CENT OF TOTAL
TOTAL EXAMINED	1,153	
Redness of Tongue	2	0.17
Atrophy of Papillae	6	0.52
Absence of Coating	9	0.78
Edema and Hypertrophy	11	0.95
Pellagrous Dermatitis	1	0.09
Number of Persons With One or More Signs	24	2.08

It is possible that had the more refined method of detecting early niacin deficiency, recently described by Kruse (26), been available, we would have recorded many more positive cases.

EVIDENCES OF VITAMIN C DEFICIENCY

The physical examination discovered no subject with any of the signs of scurvy.

On the other hand, a large number had low plasma ascorbic acid values. These values are summarized in Table 8.

Of our subjects, 32.5 per cent had plasma ascorbic acid levels below 0.4 mg. per cent. The prevailing opinion regarding the significance of a low plasma ascorbic acid is represented in the following quotation (28): "When the figure falls below .45 mg. per 100 cc. of plasma, it may be inferred—that the vitamin C depot is approaching dangerous depletion. In such circumstances, it would seem advisable to administer about 5 to 10, 200-mg. doses of ascorbic acid, as an initial step in preparing the patient for operation."

Ingalls (29) proposed the following classification of plasma ascorbic acid values:

1	- 2	mg. per cent complete saturation
1	- 0.7	normal
0.7	- 0.5	low normal
0.5	- 0.3	suboptimal
0.3	- 0.15	asymptomatic scurvy
0.15	- 0.	scurvy

Similarly, Chu and Sung (30) concluded from a combination of saturation and blood level studies that plasma levels below 0.4 mg. per cent indicated a deficiency state.

The above conclusions are derived from studies on young children. Against them must be set the findings and conclusions of Crandon, *et al* (15) in an extremely thorough study of experimental scurvy on an adult man.

They came to the conclusion that plasma ascorbic acid is a poor

index of vitamin C status, concurring in the opinion of Butler and Cushman (31) that the white-cell-platelet level is a more accurate measure. Crandon *et al* found that although the plasma ascorbic acid fell to zero after 41 days on a vitamin C free diet, the white-cell-platelet level was zero only after 82 days. Ten days after this stage, *i.e.*, after 92 days on a vitamin C free diet, the first signs of scurvy, hyperkeratotic papules, appeared; and 20 days later the petechiae characteristic of scurvy appeared. The following quotation describes some of the findings on which Crandon *et al* based their conclusions: "At the end of three months, after the plasma ascorbic acid had been zero for 44 days, a sizable wound was made on the right mid-back of the subject. Ten days later biopsy of this wound showed good healing, as compared with a normal control; histological study showed ample intercellular substance and capillary formation." A second wound made after the plasma ascorbic acid had been zero for 141 days did not heal below the skin. Following intravenous 1,000-mg. vitamin C daily, good healing set in, in a few days.

Table 8. Plasma ascorbic acid values found among 1,160 employees of the Lockheed Aircraft Corporation.^{1,2}

MG. PER 100 ML. OF PLASMA	NUMBER	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE
TOTAL EXAMINED	1,160	100.0	
Less than 0.20	124	10.7	10.7
0.20-0.39	253	21.8	32.5
0.40-0.59	231	19.9	52.4
0.60-0.79	206	17.8	70.2
0.80-0.99	164	14.1	84.3
1.00-1.19	97	8.4	92.7
1.20-1.39	55	4.7	97.4
1.40-1.59	16	1.4	98.8
1.60-1.79	8	0.7	99.5
1.80 or More	6	0.5	100.0

¹ Determined by the macro method of Mindlin and Butler employing a photoelectric colorimeter (27).

² The subjects were instructed not to take any citrus fruit or tomatoes on the day of the examination. A few did, but their values are included in the tabulation.

The findings in the teeth and gums in this experiment are especially interesting: "During the first five months of the diet (devoid of vitamin C) no changes were grossly apparent in the teeth and gums. A competent dentist pronounced the gums to be normal in appearance at the end of this time.

"At the end of six months when clinical scurvy, as manifested by the perifollicular hemorrhages of the legs had been present for three weeks, examination of the gums and teeth was made . . . ; the gums were slightly more boggy on pressure than usual, but no other gross changes could be seen. A biopsy specimen of the gingiva at this time was absolutely normal. Of interest is the fact that although the gross findings were negative, X-ray films of the teeth taken at this time showed occasional interruptions of the lamina dura."

Nevertheless in the study of Crandon *et al* the white-cell-platelet level of vitamin C had fallen to one-third of its initial value on the day the plasma level first became zero. The curves of plasma and white-cell-platelet vitamin C indicate that when the plasma level falls below about 0.2 mg. per cent the white-cell-platelet level begins to fall. From the point of view of prophylaxis the conservative position would be that a plasma ascorbic acid below 0.2 mg. per cent is unsafe. Of the subjects we examined 10.7 per cent were in this state.

The study of Crandon *et al* dealt with a case of pure vitamin C avitaminosis, induced experimentally. Care was taken to provide adequate amounts of all other vitamins. A pure vitamin C avitaminosis is a rare clinical occurrence. Commonly it is complicated by deficiency of water-soluble vitamins of the B complex. This complication may aggravate the vitamin C deficiency and bring on the signs of scurvy earlier than in experimentally induced pure vitamin C deficiency. Crandon *et al* recognized this possibility.

Another factor to be considered in interpreting plasma ascorbic acid values is the length of time the subject has been subsisting on a low vitamin C intake, *i.e.*, an intake not so low as to give a vitamin

C plasma level of zero or nearly zero, but one insufficient to maintain a fair level, *e.g.*, above 0.4 mg. per cent. Some of the characteristics of mild scurvy may develop even though the plasma may still contain detectable amounts of vitamin C. The observations of Kruse (26) indicate that this may be the case, indeed that it is common.

Plasma ascorbic acid values reflect only recent dietary history (32). In the case of any one individual a low value may not indicate the habitual physiological state of the individual or reflect the character of his usual diet. When, as in the case of the present survey, 32.5 per cent of 1,160 men taken at random have plasma ascorbic values below 0.4 mg. per cent and 10.7 per cent below 0.2 mg. per cent, there is a high degree of probability that the low plasma vitamin C content which characterizes the group as a whole, does reflect the habitual diet of these men and indicates a low vitamin C content in their tissues.

It is remarkable that the vitamin C intake should be low in so high a percentage of men residing in this citrus-growing region, where citrus fruit and leafy vegetables are cheaper throughout the year than in most parts of the country. Eating habits appear to have changed for the worse in this region since 1938 when a nutrition survey in Pasadena indicated that even the poor, on relief, were obtaining in excess of 70 mg. of ascorbic acid daily, of which a little less than half came from citrus fruit, the remainder mainly from leafy vegetables.

One reason for the change in the picture since 1938 may be that the scanty breakfast of many of these men is responsible for the low consumption of citrus fruit and tomatoes. These fruits are commonly consumed either at breakfast or not at all.

SERUM ALBUMIN

Serum albumin was determined on 195 out of 200 consecutive subjects. The results are summarized in Table 9. They show that

all the values fell within the normal range of 3.95 to 5.24 (33). This result was to be expected; the protein intake of practically all of the subjects was adequate (5), and a lowering of the serum albumin follows only on severe and prolonged protein undernutrition (in the absence of organic disease).

We felt justified after finding that 195 consecutive subjects gave normal values in discontinuing the serum albumin determinations.

Table 10. Hemoglobin values: grams per 100 ml. of blood¹ among 1,170 employees of the Lockheed Aircraft Corporation.

GRAMS PER 100 ML.	NUMBER	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE
TOTAL EXAMINED	1,170	100.0	
7.53	1	0.09	0.09
10.12	1	0.09	0.17
11.50-11.99	3	0.26	0.43
12.00-12.49	7	0.6	1.0
12.50-12.99	34	2.9	3.9
13.00-13.49	90	7.7	11.6
13.50-13.99	202	17.3	28.9
14.00-14.49	273	23.3	52.2
14.50-14.99	313	26.8	79.0
15.00-15.49	162	13.8	92.8
15.50-15.99	56	4.8	97.6
16.00 or More ²	28	2.4	100.0

¹ Determined by photometer—instrument calibrated by oxygen combining capacity determinations. Grams of hemoglobin per 100 ml. = oxygen combining capacity per 100 ml. multiplied by 0.736 (36).

² The highest value observed was 17.7 gm.

Range	Number	Per Cent of Total Number
TOTAL	195	100
3.90-3.99	5	2.6
4.00-4.09	8	4.1
4.10-4.19	17	8.7
4.20-4.29	28	14.4
4.30-4.39	25	12.8
4.40-4.49	22	11.3
4.50-4.59	27	13.8
4.60-4.69	25	12.8
4.70-4.79	21	10.8
4.80-4.89	9	4.6
4.90-4.99	7	3.6
5.00-5.09	1	0.5

¹ Determined by the method of Robinson and Hogden (34) after separating the serum albumin by the method of Kingsley (35).

Table 9. Serum albumin in 195 out of 200 consecutive subjects.¹

HEMOGLOBIN

Table 10 contains a summary of the hemoglobin values. According to Wintrobe (37) the range of normal hemoglobin values for adult males is 16.0 ± 2.0 gm. per 100 ml. In 29 per cent of our subjects the hemoglobin value was below 14.0 and 3.9 per cent below 13.0.

Wintrobe chose 14.5 gm. per 100 ml. as a standard for 100 per cent hemoglobin. Taking this value as a standard, 52 per cent of our subjects had less than "100 per cent" hemoglobin.

There is a clear indication of a tendency to low hemoglobin values in this whole group of men, unless it be that the normal

Table 11. Volume of packed red cells.¹

Volume Per Cent	Number	Per Cent of Total	Cumulative Percentage
TOTAL EXAMINED	1,170	100.0	
31	1	.09	0.09
38	1	.09	0.18
41	5	0.43	0.61
42	12	1.0	1.6
43	17	1.5	3.1
44	63	5.4	8.5
45	81	6.9	15.4
46	148	12.6	28.0
47	173	14.8	42.8
48	213	18.2	61.0
49	155	13.2	74.3
50	138	11.8	86.1
51	93	7.9	94.0
52	43	3.7	97.7
53	12	1.0	98.7
54	8	0.68	99.4
55	6	.51	99.9
58	1	.09	100.0

¹Hematocrit tubes were centrifuged at 3,000 to 3,400 R.P.M. for 45 minutes after which time there was no further change in volume at this speed.

"100 per cent" value of 43.2.

DETAILED HEMATOLOGICAL STUDY OF 228 CASES

It was not feasible in the time at our disposal to make a red cell

range of 16.0 ± 2.0 and a 100 per cent value of 14.5 gm. are too high. (See discussion below.)

On the other hand, the volume of packed red cells tended to be higher than Wintrobe's normal range of 47.0 ± 7.0 , with 43.2 as the "100 per cent" value as shown in Table 11. The median was 47.9, and the semi-quartile range was between 46.3 and 49.6. Only 0.2 per cent was below 40, and 97 per cent had cell volumes higher than Wintrobe's

Table 12. Hematological determinations on 228 consecutive male subjects and on 110 men with hemoglobin values of less than 13.4 grams per 100 ml. of blood.

HEMATOLOGICAL DETERMINATION AND CLASS INTERVALS	CONSECUTIVE SUBJECTS			ANEMIC CASES		
	Number of Cases	Per Cent of Total	Cumulative Percentage	Number of Cases	Per Cent of Total	Cumulative Percentage
HEMOGLOBIN, GMS. PER 100 ML. — RANGE OF NORMAL VALUES = 16.0 ± 2.0 GMS.						
TOTAL	228	100.0		110	100.0	
16.20-16.79	3	1.3	1.3			
16.00-16.19	8	3.5	4.8			
15.80-15.99	2	0.9	5.7			
15.60-15.79	2	0.9	6.6			
15.40-15.59	6	2.6	9.2			
15.20-15.39	19	8.3	17.5			
15.00-15.19	15	6.6	24.1			
14.80-14.99	23	10.1	34.2			
14.60-14.79	19	8.3	42.6			
14.40-14.59	27	11.8	54.4			
14.20-14.39	21	9.2	63.6			
14.00-14.19	20	8.8	72.4			
13.80-13.99	24	10.5	82.9			
13.60-13.79	11	4.8	87.7			
13.40-13.59	7	3.1	90.8			
13.20-13.39	8	3.5	94.3	42	38.2	38.2
13.00-13.19	5	2.2	96.5	25	22.7	60.9
12.80-12.99	2	0.9	97.4	16	14.6	75.5
12.60-12.79	2	0.9	98.3	12	10.9	86.4
12.40-12.59	1	0.4	98.7	5	4.6	91.0
12.20-12.39	2	0.9	99.6	3	2.7	93.7
12.00-12.19			99.6	2	1.8	95.5
11.80-11.99	1	0.4	100.0	2	1.8	97.3
11.60-11.79				1	0.9	98.2
10.12				1	0.9	99.1
7.53				1	0.9	100.0
RED BLOOD CELLS ¹ , MILLIONS PER CU. MM. — RANGE OF NORMAL VALUES = 5.4 ± 0.8						
TOTAL	228	100.0		110	100.0	
8.00-8.19	1	0.4	0.4			
7.00-7.19	5	2.2	2.6			
6.80-6.99	4	1.8	4.4	1	0.9	0.9
6.60-6.79	9	3.9	8.3			
6.40-6.59	15	6.6	14.9	1	0.9	1.8
6.20-6.39	17	7.5	22.4			
6.00-6.19	30	13.2	35.5	8	7.3	9.1
5.80-5.99	29	12.7	48.2	7	6.4	15.5
5.60-5.79	40	17.5	65.8	15	13.6	29.1
5.40-5.59	30	13.2	79.0	18	16.4	45.5
5.20-5.39	26	11.4	90.4	18	16.4	61.8
5.00-5.19	9	3.9	94.3	19	17.3	79.1
4.80-4.99	9	3.9	98.3	10	9.1	88.2
4.60-4.79	3	1.3	99.6	9	8.2	96.4
4.40-4.59	1	0.4	100.0	1	0.9	97.3
4.20-4.39	0			3	2.7	100.0

HEMATOLOGICAL DETERMINATION AND CLASS INTERVALS	CONSECUTIVE SUBJECTS			ANEMIC CASES		
	Number of Cases	Per Cent of Total	Cumulative Percentage	Number of Cases	Per Cent of Total	Cumulative Percentage
VOLUME OF PACKED CELLS, PER CENT — RANGE OF NORMAL VALUES = 47 ± 7						
TOTAL	228	100.0		110	100.0	
55	2	0.9	0.9			
54	3	1.3	2.2			
53	5	2.2	4.4			
52	14	6.1	10.5			
51	16	7.0	17.5			
50	32	14.0	31.6	1	0.9	0.9
49	27	11.8	43.4			
48	42	18.4	61.8	5	4.6	5.5
47	33	14.5	76.3	6	5.5	10.9
46	29	12.7	89.0	15	13.6	24.5
45	8	3.5	92.5	21	19.1	43.6
44	12	5.3	97.8	33	30.0	73.6
43	2	0.9	98.7	13	11.8	85.5
42	3	1.3	100.0	10	9.1	94.6
41				4	3.6	98.2
38				1	0.9	99.1
31				1	0.9	100.0

¹ The red cell counting chambers were set up in the usual manner in duplicate. The fields were photographed and the count made on the developed films.

Table 12 continued.

count on every subject. In order to get an impression of the range of red cell counts in this group, counts were made routinely on the first four cases examined each morning. A summary of the findings in this group consisting of 228 cases is given in Tables 12 and 13, and in Figure 1.

Table 12 shows that in these 228 consecutive subjects, the hemoglobin values tended to be lower than would be expected from Wintrobe's normal range of 16.0 ± 2.0 gm. There were only eleven cases, 6.1 per cent, above 16.0 gm. and 63 cases, 27.6 per cent below 14.0 gm. The tendency was the same here as in the whole group surveyed.

Table 13. Derived mean values for red blood corpuscles for 228 consecutive male subjects and for 110 men with hemoglobin values less than 13.40 grams per 100 ml. of blood.

MEAN CORPUSCULAR VOLUMES	CONSECUTIVE SUBJECTS			ANEMIC CASES		
	NUMBER OF CASES	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	NUMBER OF CASES	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE
VOLUME, CUBIC MICRONS, ¹ — RANGE OF NORMAL VALUES = 87 ± 5						
TOTAL	228	100.0		110	100.0	
102.0-104.9	3	1.3	1.3	3	2.7	2.7
99.0-101.9	4	1.8	3.1	1	0.9	3.6
96.0-98.9	4	1.8	4.8	2	1.8	5.5
93.0-95.9	12	5.3	10.1	3	2.7	8.2
90.0-92.9	12	5.3	15.3	6	5.5	13.6
87.0-89.9	22	9.6	25.0	12	10.9	24.5
84.0-86.9	41	18.0	43.0	21	19.1	43.6
81.0-83.9	44	19.3	62.3	20	18.2	61.8
78.0-80.9	45	19.7	82.0	20	18.2	80.0
75.0-77.9	19	8.3	90.3	8	7.3	87.3
72.0-74.9	15	6.6	96.9	11	10.0	97.3
69.0-71.9	5	2.2	99.1	1	0.9	98.2
66.0-68.9	1	0.4	99.6			
63.0-65.9	1	0.4	100.0	1	0.9	99.1
60.0-62.9				1	0.9	100.0
HEMOGLOBIN, MICRO-MICROGRAMS ² — RANGE OF NORMAL VALUES = 29 ± 2						
TOTAL	228	100.0		110	100.0	
31	1	0.4	0.4	1	0.9	0.9
30	2	0.9	1.3	1	0.9	1.8
29	7	3.0	4.4	1	0.9	2.7
28	8	3.5	7.9	2	1.8	4.5
27	17	7.5	15.4	7	6.4	10.9
26	31	13.6	29.0	14	12.7	23.6
25	42	18.4	47.4	18	16.4	40.0
24	51	22.4	69.8	19	17.3	57.3
23	37	16.2	86.0	19	17.3	74.5
22	22	9.6	95.6	14	12.7	87.3
21	7	3.1	98.7	10	9.1	96.4
20	1	0.4	99.1	2	1.8	98.2
19	1	0.4	99.6			
18	1	0.4	100.0			
15				2	1.8	100.0

MEAN CORPUSCULAR VOLUMES	CONSECUTIVE SUBJECTS			ANEMIC CASES		
	NUMBER OF CASES	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	NUMBER OF CASES	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE
HEMOGLOBIN CONCENTRATION, PER CENT ³ — RANGE OF NORMAL VALUES = 34 ± 2						
TOTAL	228	100.0		110	100.0	
33	1	0.4	0.4			
32	8	3.5	3.9			
31	23	10.1	14.0	2	1.8	1.8
30	80	35.1	49.1	26	23.6	25.5
29	82	36.0	85.1	49	44.5	70.0
28	31	13.6	98.7	21	19.1	89.1
27	3	1.3	100.0	8	7.3	96.4
26				2	1.8	98.2
25						
24				1	0.9	99.1
23				1	0.9	100.0

¹ Mean corpuscular volume = $\frac{\text{volume packed red cells per 1000 ml.}}{\text{red cell count, millions per cu. mm.}}$

² Mean corpuscular hemoglobin = $\frac{\text{hemoglobin, gms. per 1000 ml.}}{\text{red cell count, millions per cu. mm.}}$

³ Mean corpuscular hemoglobin concentration = $\frac{\text{hemoglobin, gms. per ml.} \times 100}{\text{volume packed red cells per 100 ml.}}$

Table 13 continued.

The question arises: What is a proper normal hemoglobin value? This question has been discussed by Leslie (38). In 928 adult males living in New York, Leslie found a mean average value of 14.7 gm., a median value of 14.7 gm., a semi-quartile range of 14.1 – 15.5, and the complete range to be 11.2 – 18.2. In the age range 20 to 60, no effect of age was observed.

In the subjects of the present survey the median hemoglobin value is 14.45 gm. Increasing this value by 1.4 per cent (to make our values comparable with Leslie's, since we used the Van Slyke coefficient for converting oxygen combining capacity to grams of hemoglobin, and Leslie used the Hufner value) it becomes 14.65, a value identical with that found in the New York series.

The conclusion is justified, therefore, that our group may be

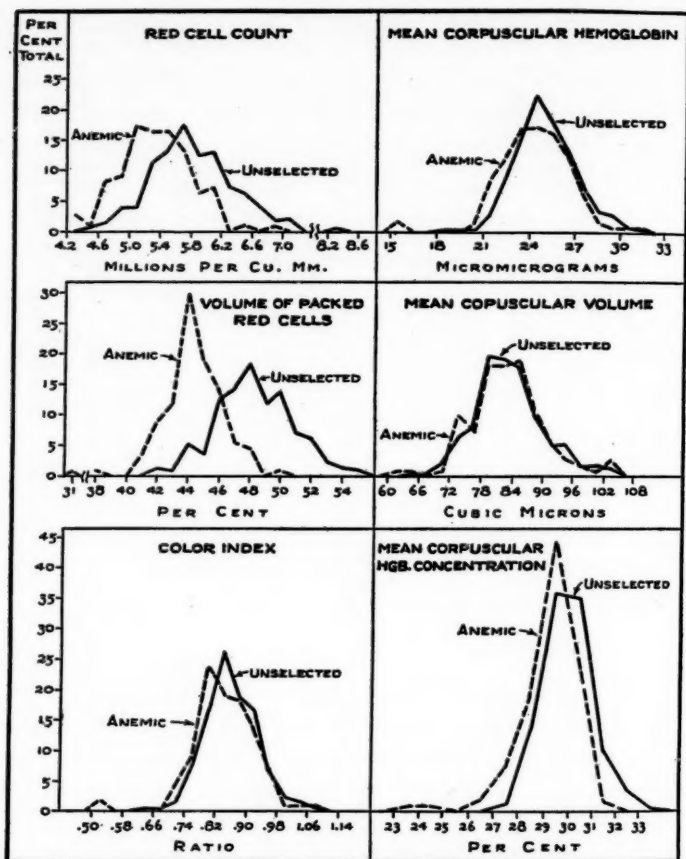


Fig. 1. Percentage distributions of hematological values for an unrelated group of employees and for employees having hemoglobin values of less than 13.4 gms. per 100 ml. of blood.

considered "normal" with respect to hemoglobin concentration although they tend to be lower than Wintrobe's normal range of 16.0 ± 2.0 .

The red cell counts on the other hand, tended to be higher than would be expected from Wintrobe's normal range of 5.4 ± 0.8 .

Fifty-one cases, or 22.4 per cent, were 6.2 or above, and only one case, 0.4 per cent, was below 4.6. We cannot state, at present, the reason for the range of values in our group being higher than the range proposed by Wintrobe; it may, possibly, reside in the counting technique we used.

The range of red cell volumes also was higher than Wintrobe's normal of 47 ± 7 , and was similar to that found in the whole group. The distribution curve is skewed toward the side of higher values; forty, or 17.5 per cent, were 50.5 or above and five, or 2.2 per cent, below 43.5, with none below 41.5.

A summary of the findings in this group of 228 consecutive subjects is therefore that the hemoglobin values tended to be lower and those for red cell count and red cell volume higher than suggested by the normal ranges proposed by Wintrobe. If one uses the latter's criteria for normality, there is a tendency in nearly all our subjects toward subnormal filling of the red cells. The question whether this tendency is real or an artifact arising from the inapplicability of Wintrobe's normal standards to our group, or to the techniques we have used, must, for the present, be left in abeyance.

PREVALENCE OF ANEMIA

There were 126 subjects with hemoglobin values less than 13.4 gm. A hemoglobin value of less than 13.4 gm. is subnormal by any of the accepted standards for the "normal" hemoglobin of adult men. In this group, 10.8 per cent were, therefore, anemic, in degrees varying from mild to moderately severe.

The significance of this finding to the appraisal of the health of workers generally in this country is heightened by the following ancillary facts. This group of men, of whom 10.8 per cent were anemic, were selected in part by a pre-employment medical examination. The health of the group must be considered, therefore, as having been above the average of the population at large. They were young; 71 per cent were under 30 and 86 per cent under 35.

Their original homes were in most of the middle and western states. Finally the criterion by which the 10.8 per cent were diagnosed as anemic is far from one of perfection. If, for example, the range of normal values given by Wintrobe, 16.0 ± 2 , had been used, there would have been 29 per cent with subnormal (*i.e.*, below 14.0 gm.) hemoglobin.

Red blood cell counts were also made on 110 subjects whose hemoglobin values were below 13.4 gm. per 100 ml. The hematological data on this group also are given in Tables 12 and 13, and Figure 1.

The red cell counts in all but four of the 110 anemic subjects were within, or higher than, the normal range, 5.4 ± 0.8 millions per cu. mm., 20.9 per cent were below 5.0 million; none were lower than 4.2 million. But the values in this group, taken as a whole, were definitely lower than in the unselected series of 228 consecutive subjects.

Similarly the red cell volumes were also definitely lower than in the unselected series. The tendency toward lower red cell volumes almost exactly balanced the tendency toward lower red cell counts. As a result the percentage distribution of mean cell volumes was almost identical in the unselected and anemic series (Table 13 and Figure 1).

One difference between the unselected and anemic series, therefore, is that the latter subjects had fewer red cells. Another difference is that the degree of filling of the red blood cells was less in the anemic than in the unselected series. This is shown in Tables 13 and 14 and Figure 1 by the comparisons in the values in the two groups of the mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and color index.

It will be observed in Tables 13 and 14 that the values in the unselected series for mean corpuscular volume, hemoglobin, hemoglobin concentration, and color index all tend to be lower than the normal ranges cited. These normal ranges are those proposed by

Color Index ¹	CONSECUTIVE SUBJECTS			ANEMIC CASES		
	Number	Per Cent of Total	Cumulative Percentage	Number	Per Cent of Total	Cumulative Percentage
TOTAL	228	100.0		100	100.0	
1.06-1.09	1	0.4	0.4	1	0.9	0.9
1.02-1.05	4	1.8	2.2	1	0.9	1.8
.98-1.01	6	2.6	4.8	1	0.9	2.7
.94-.97	16	7.0	11.8	8	7.3	10.0
.90-.93	38	16.7	28.5	15	13.6	23.6
.86-.89	43	18.9	47.4	20	18.2	41.8
.82-.85	60	26.3	73.7	21	19.1	60.9
.78-.81	37	16.2	89.9	26	23.6	84.5
.74-.77	17	7.5	97.4	10	9.1	93.6
.70-.73	4	1.8	99.2	5	4.5	98.2
.66-.69	1	0.4	99.6			
.62-.65	1	0.4	100.0			
.58-.61						
.54-.57						
.50-.53				2	1.8	100.0

¹ Normal, or 1.0, is taken as 14.5 gms. per 5.0 million red cells, and the color index = $\frac{\text{hemoglobin (gm.)}}{14.5} \cdot \frac{\text{red cell count}}{5,000,000}$.

Table 14. Color index of red blood corpuscles for 228 consecutive male subjects and for 110 men with hemoglobin values of less than 13.40 gms. per 100 ml. of blood.

Wintrobe. If the latter's criteria of normality be accepted, then most of the subjects in the study, probably over 90 per cent, regardless of how high the hemoglobin level, had hypochromic anemia, because their values for mean corpuscular hemoglobin concentration were below the normal range of 34 ± 2 . This is highly improbable. A more reasonable conclusion is that the normal values proposed by Wintrobe are not applicable in the present study.

Table 15 summarizes the morphological classification of the anemias. This classification is based on that of Wintrobe using, however, instead of Wintrobe's normal values those derived from data obtained by the same techniques on 207 non-anemic men, *i.e.*, with higher hemoglobin values. There were 43.6 per cent in the

CLASS OF ANEMIA	DEFINITION OF CLASS OF ANEMIA ¹				Number	Per Cent of Total
	Number of R. B. C.	Mean Corpuscular Values				
		Volume	Hemoglobin Content	Hemoglobin Concentration		
Macrocytic	Subnormal	Above Normal	Above Normal	Normal or Subnormal	3	2.7
Macrocytic Questionable					2	1.8
Normocytic	Subnormal	Normal	Normal	Normal	37	33.6
Normocytic Questionable	Borderline	Normal or Borderline	Normal	Normal	11	10.0
Simple Hypochromic	Normal or Subnormal	Normal	Normal or Subnormal	Subnormal	22	20.0
Hypochromic Questionable	Normal or Subnormal	Normal	Normal or Subnormal	Borderline	4	3.6
Microcytic	Normal or Subnormal	Subnormal	Subnormal	Normal	19	17.3
Microcytic Questionable	Normal	Borderline	Borderline	Normal	4	3.6
Microcytic & Hypochromic	Normal or Subnormal	Subnormal	Subnormal	Subnormal	8	7.3
TOTAL					110	100.0

¹ For each hematological value, "normal" means within limits of a standard range; borderline means close to lower limit of range; and subnormal means less than lower limit of range. Lower limits for normal or standard value were: red cell count, 5.3 million; volume, 79 cu. microns; hemoglobin content, 23 micro-micrograms; hemoglobin concentration, 29.0 per cent. Mean cell volumes for macrocytic cases were 102 or 103 cubic microns; for questionable cases, 98 and 99.

Table 15. Morphological classification of anemias for 110 men with hemoglobin values of less than 13.4 gms. per 100 ml. of blood, using standards for normal levels derived from data obtained by same techniques for 207 men with higher hemoglobin values.

category of normocytic anemia, 23.6 per cent with simple hypochromic anemia, 20.9 per cent with microcytic anemia, and 7.3 per cent with microcytic and hypochromic anemia. It must be emphasized that most of these anemias are mild.

SOME FEATURES OF THE MEDICAL HISTORIES NOT INCLUDED ABOVE

A. Gastro-Intestinal Function

	<i>Per Cent</i>
Appetite—a. Good	60
b. Fair	33
c. Poor	8
Indigestion	23
Diarrhea	6
Constipation	21
No Gastro-Intestinal Complaints	60

There are many indications in the literature (39, 40, 41) that gastro-intestinal discomfort or malfunction of the so-called "functional" type, can frequently be relieved by administration of one or more components of the vitamin B complex. It is a reasonable surmise, therefore, that the frequency of gastro-intestinal discomfort in this group, is in part a consequence of malnutrition.

B. Eyes and Vision

In the Company's pre-employment examination, the vision of the men was examined and classified as "good," "fair," or "poor." From the Company's records, we obtained the following summary: good, 85 per cent; fair, 14 per cent; poor, 1 per cent.

Nevertheless, as discussed above in the section on evidences of riboflavin deficiency, there were many complaints of visual and ocular discomfort.

C. Colds

Continuous or frequent colds were reported by 14 per cent, in addition to 64 per cent who reported one or more colds in the preceding three months. There were only 22 per cent who reported they had no cold during this time.

D. Fatigue and Irritability

Twelve per cent found their work excessively tiring. Nine per cent stated that they were easily irritated by their companions at work, and 11 per cent were easily irritated at home. Fourteen per cent believed their work was injurious to their health.

Summary of the Findings in the Medical Histories

The medical histories disclosed that there was in this group of men a great deal of what has appropriately been called "dis-ease." Many are not comfortable at their work or at home. The complaints were most commonly of the gastro-intestinal tract or of the eyes. It is true that these disturbances are minor; nevertheless, they rob the men of a feeling of well-being.

It is a challenge that 40 per cent of the men examined complained of gastro-intestinal discomfort. It is a challenge because these men would be rated as healthy young men; most of them are under 30. They are a selected group; they all underwent a pre-employment examination, and their health was an important item in their selection for employment. The factor of selection is real, because at the time these men sought employment there were many applications for employment, and accordingly the standards on which selection was based were high.

SUMMARY

1. A nutrition survey among workers in an aircraft industry in Southern California was begun in November, 1941.
2. The objectives in this survey are:
 - A appraisal of present nutritional condition.
 - A study of the effects on health and working ability of nutritional supplements.
3. The medical and laboratory examinations consisted of the following: medical history, physical examination, biomicroscopic examination of the conjunctiva and cornea, plasma ascorbic acid,

serum protein concentration, hemoglobin, red cell count, red cell volume, and serological tests (Kahn and Kolmer) for syphilis.

4. The reliability of some of the above tests as diagnostic methods of mild or chronic nutritional deficiency are discussed.

5. This report summarizes the findings on the nutritional condition of the men at the time they were first examined (November, 1941-February, 1942).

6. Most of the men were relatively young, under 30.

7. Only two cases of definitely positive, and two cases of questionably positive serology for syphilis were found among 1,205 subjects examined.

8. The distribution of weight to height and age was within the standard normal range.

9. The serum protein concentration was normal in every subject examined.

10. Nearly every subject showed evidence of vitamin A deficiency (past or present), by the criterion that thickening, opacity, or localized elevation of the conjunctiva is evidence of vitamin A deficiency.

11. Between 17 per cent and 26 per cent, depending on the criterion, showed evidence of thiamin deficiency (past or present).

12. In 9 per cent of the subjects, a seborrheic condition of the face, or fissures of the lips or angles of the mouth were found, indicative of riboflavin deficiency. 35 per cent complained of ocular symptoms commonly found in cases of riboflavin deficiency.

13. Some degree of corneal vascularity was found in every subject. By this criterion nearly every subject showed evidence of riboflavin deficiency (past or present).

14. Evidence of severe niacin deficiency was found in only 2.1 per cent of the subjects.

15. 32 per cent of the subjects had a plasma ascorbic acid concentration below 0.4 mg. per cent; and another 20 per cent below 0.6 mg. per cent.

16. The red cell counts and red cell volumes were "normal" (or higher) in nearly all the subjects examined. About 11 per cent (126 out of 1,170) had hemoglobin values of less than 13.4 gm. per 100 ml. These must be considered as anemic. The red cell counts were subnormal in only four of 110 anemic cases. There were three cases of macrocytic anemia.

17. 40 per cent complained of gastro-intestinal discomfort or disturbances. The commonest complaints were of indigestion and constipation.

18. 63 per cent reported that they had had one or more colds in the preceding three months.

19. 12 per cent found their work excessively tiring.

20. Attention is drawn to the challenging circumstance that there is so much gastro-intestinal and ocular discomfort in a group of young, selected, presumably healthy men, and also to the relatively high incidence of anemia.

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RECENT CHANGES IN INCOME AND FOOD EXPENDITURES AMONG TUBERCULOUS FAMILIES IN HARLEM¹

JEAN DOWNES

THE war is bringing changes in the trend of mortality from tuberculosis. Increases in the death rate have been reported from various European countries, including Great Britain. In 1941 Canada reported that tuberculosis had gone up from eighth to seventh place as a cause of death. Preliminary data for 1942 indicate an increase in mortality and morbidity among residents of upstate New York; for the United States as a whole there is indication of a slight decline in the death rate. Increase in tuberculosis mortality at this particular time may be interpreted as due in part to a lowering of human resistance, which Frost has called "non-specific resistance" to the disease. He cited factors as probably increasing resistance, namely, "environmental improvements such as better nutrition and relief from physical stress." In the light of these observations, an examination of recent changes in certain social and economic conditions of tuberculous families is appropriate, since these families constitute a population in most imminent danger of contracting the disease.

The data describing changes in income and food expenditures are from records of a special study of tuberculosis which is being carried on in Negro families in the Harlem area of New York City. The periods compared are (1) February to November, 1940 and (2) January 1, 1943. At monthly intervals, information has been obtained from the families concerning the amount of income from all sources and the amount spent for food per week.

Table 1 shows the distribution of the families according to the average annual income in 1940 compared with January 1, 1943. In

¹ From the Milbank Memorial Fund, the Community Service Society of New York, and the New York City Department of Health.

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Table 1. Distribution of families according to average annual income in 1940, compared with January 1, 1943—Harlem area of New York City.

Classification of Average Annual Income Per Adult Cost Unit	202 Families Surveyed February 1- November 30, 1940	88 Families Surveyed December, 1942 and January, 1943
	Per Cent	
TOTAL	100.0	100.0
Less Than \$200	13.8	10.2
\$ 200-\$ 299	32.2	14.8
300- 399	22.3	15.9
400- 499	14.4	9.1
500- 599	9.9	12.5
600- 699	1.5	10.2
700- 799	3.0	8.0
800- 899	0.4	5.7
900- 999	2.5	5.7
1,000- 1,099		2.3
1,100- 1,199		2.3
1,200 and Over		3.3

Table 2. Distribution of families according to weekly amount spent for food in 1940, compared with January 1, 1943—Harlem area of New York City.

Classification of Weekly Amount Spent for Food Per Adult Cost Unit	202 Families Surveyed February 1- November 30, 1940	94 Families Surveyed December, 1942 and January, 1943
	Per Cent	
TOTAL	100.0	100.0
\$1.00-\$1.99	23.0	0
2.00- 2.99	42.7	8.5
3.00- 3.99	19.7	34.0
4.00- 4.99	9.9	31.9
5.00- 5.99	2.3	14.9
6.00- 6.99	1.9	4.3
7.00- 7.99	0	3.2
8.00- 8.99	0.5	2.1
9.00- 9.99	0	1.1

1940 almost half of the families (46 per cent) had an average annual income per adult cost unit of less than \$300; at present only one-fourth of the families are in this class. Fifty per cent of the families now have an average income of \$500 or more per cost unit per year, compared with 17 per cent in 1940.

The changes in food expenditure per week are shown in Table 2. In 1940, 66 per cent of the families spent less than \$3.00 per cost unit per week; at present only 8 per cent of the families are spending as little as that for food. The majority of the families (66 per cent) are spending from \$3.00 to \$4.99 per cost unit per week.

The increases in income and food expenditure may be further described by a comparison of the means for the

PERIOD OF TIME	MEAN AVERAGE ANNUAL INCOME PER ADULT COST UNIT	STANDARD DEVIATION σ	NUMBER OF FAMILIES
February 1–November 30, 1940	\$357 \pm 12.1	171.93	202
December, 1942–January, 1943	\$662 \pm 36.3	340.45	88

Table 3. Average annual income in 1940, compared with January 1, 1943—Harlem area of New York City.

families in the two periods. These data are presented in Tables 3 and 4. The mean average annual income per cost unit showed an 85 per cent increase, as of January 1, 1943, over 1940.³ The mean weekly expenditure for food increased 53 per cent in the same time period.⁴ This increase is somewhat greater than the change in the cost of food in the same period of time. The cost of an estimated minimum-cost diet has on the average increased approximately 44 per cent.

An increase in expenditure for food was to be expected because of the increase in the cost of food. An important question is: Are these families now spending on the average enough to provide a fairly adequate diet? Table 5 shows the average expenditure for

³ The increase in income has been due largely to an increase in employment and to changes in employment. In 1940, 30 per cent of persons 16 years of age and over were employed, compared with 49 per cent in January, 1943. Also, there are now more employed persons per family; in 1940 the number of employed persons per family was 0.6, compared with 1.1 per family in January, 1943. Twenty-three per cent of the persons employed in 1940 were on work relief projects; only 2 per cent of the total employed in 1943 were on WPA projects. These changes in employment are especially significant in view of the fact that some persons of employable ages have gone from these families into the armed forces.

	MEAN VALUE IN DOLLARS		DIFFERENCES
	1940	January, 1943	
Weekly Food Expenditure Per Adult Cost Unit	2.86	4.38	1.52 \pm 0.16
Average Annual Income Per Adult Cost Unit	357.50	662.10	304.60 \pm 38.25

The differences between the means are statistically significant, that is, they are greater than would be expected to occur as chance variations.

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PERIOD OF TIME	MEAN WEEKLY FOOD EXPENDITURE PER ADULT COST UNIT	STANDARD DEVIATION σ	NUMBER OF FAMILIES
February 1–November 30, 1940	\$2.86 \pm .08	1.14	212
December, 1942–January, 1943	\$4.38 \pm .14	1.35	94

Table 4. Average weekly food expenditure in 1940, compared with January 1, 1943—Harlem area of New York City.

food per cost unit, according to size of family, for the families surveyed January, 1943, compared with the average amount estimated as necessary for families of the same size. The estimated amount of money necessary for food is based on present food costs in New

Table 5. Average expenditure for food in families classified according to size of family, compared with an average minimum expenditure estimated as necessary to obtain a good diet—Harlem area of New York City, December, 1942 and January, 1943.

SIZE OF FAMILY IN ADULT COST UNITS	AVERAGE EXPENDITURE FOR FOOD PER WEEK PER ADULT COST UNIT	ESTIMATED MINIMUM COST FOR FOOD PER ADULT COST UNIT PER WEEK ²	NUMBER OF FAMILIES
<i>One Person</i> (0.85–1.00)	\$5.74	\$4.05	18
<i>Two Persons</i> Two Adults or One Adult and One Child ¹ (1.39–1.96)	4.51	3.90	22
<i>Three Persons or More</i> (2.36–2.96)	4.06	3.30	28
(3.03–3.70)	4.02	3.10	10
(3.75–4.71)	3.53	3.10	10
(4.75 and Over)	3.26	3.10	6

¹ In a few instances, family includes one adult and two very small children.

² The standard for the amount of money needed for food expenditure was obtained from the Table of Food Allowances, which is a part of the Schedule for Planning Budgets, issued by the Community Service Society for use by members of its staff. The Schedule for Planning Budgets is issued at intervals and takes account of changes in the cost of food and other items of living which are a part of the family budget. The Table of Allowances, dated January, 1943, was the one used as a standard for the data in this table.

In computing the average weekly amount of money needed for food, account was taken of the food requirements, by sex, of adults and of children of different ages.

York City and all of the data take into account the food requirements, by sex, of adults and of children at different ages. The estimated necessary expenditure is, however, a minimum amount needed. On the average, families are spending somewhat more than the estimated minimum amount needed. Families of relatively large size have food expenditures closest to the minimum amount needed.

In 1940 the average expenditure for food was much closer to the estimated minimum cost of food. These data are shown in Table 6. The small families (one- or two-person families) on the average spent somewhat more for food than the estimated minimum amount needed. On the other hand, the very large families on the average spent less for food than the estimated minimum amount needed for a balanced diet.

Table 6. Average expenditure for food in families classified according to size of family, compared with an average minimum expenditure estimated as necessary to obtain a good diet—Harlem area of New York City, February 1 to November 30, 1940.

SIZE OF FAMILY IN ADULT COST UNITS	AVERAGE EXPENDITURE FOR FOOD PER WEEK PER ADULT COST UNIT	ESTIMATED MINIMUM COST FOR FOOD PER ADULT COST UNIT PER WEEK ²	NUMBER OF FAMILIES
<i>One Person</i> (0.85-1.00)	\$4.12	\$3.18	27
<i>Two Persons</i> Two Adults or One Adult and One Child ¹ (1.39-1.96)	2.94	2.68	56
<i>Three Persons or More</i> (2.36-2.96)	2.53	2.40	56
(3.02-3.73)	2.47	2.15	35
(3.75-4.71)	1.95	2.14	17
(4.75 and Over)	1.93	2.10	21

¹ In a few instances, family includes one adult and two very small children.

² The standard for the amount of money needed for food expenditure was obtained from the Table of Food Allowances, which is a part of the Schedule for Planning Budgets, issued by the Community Service Society for use by members of its staff. The Schedule for Planning Budgets is issued at intervals and takes account of changes in the cost of food and other items of living which are a part of the family budget. The Table of Allowances, dated July, 1939, was the one used as a standard for the data in this table. Study of retail food prices in New York City in 1940 indicated approximately the same level as in 1939.

In computing the average weekly amount of money needed for food, account was taken of the food requirements, by sex, of adults and of children of different ages.

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Expenditure of sufficient money for food does not necessarily insure a good diet. To obtain a good diet with a minimum expenditure requires careful management and some knowledge of food values. A study of food habits in these families has shown that there is a relationship between the quality of the diet and the amount of money spent for food. However, 44 per cent of the families had food habits rated as "fair or poor" even when the food expenditure was considered satisfactory.⁴ Even though income in the families has increased considerably, and on the average expenditures for food are now within amounts required for a good diet, it is wise to continue instruction as to proper food habits in these families.

⁴Downes, Jean: A Study of Food Habits of Tuberculous Families in a Harlem Area of New York City. See page 164.

A STUDY OF FOOD HABITS OF TUBERCULOUS FAMILIES IN A HARLEM AREA OF NEW YORK CITY¹

JEAN DOWNES

IT is generally believed that an adequate diet may improve general health and help to increase nonspecific resistance to infection. Consequently, improvement in the dietary levels of families which have been exposed to infectious tuberculosis has been one of the points of emphasis in an experimental program of control of the disease among Negroes in an area of Upper Harlem. This report describes the quality of the diets of the tuberculous families and the changes in quality brought about during a period of public health nursing supervision.

The special program for control of tuberculosis was set up in an area of Upper Harlem, comprised of some thirty-five city blocks. Thirty-two thousand Negroes in 8,500 household units live in this area. The families of all active or recently active cases of tuberculosis in the area are being given intensive public health nursing and clinic supervision.

Dr. Herbert R. Edwards, Director of the Bureau of Tuberculosis, is medical director of the study. The medical staff of the tuberculosis clinic is provided by the Department of Health. The nursing and clerical staffs are provided by the Community Service Society. The nurses represent the Department of Health and are responsible for the public health nursing care of the tuberculous patients and their families. The nurses who do the home visiting also serve in the clinic.²

¹ From the Community Service Society, the New York City Department of Health, and the Milbank Memorial Fund.

² The nursing and clerical staffs of the tuberculosis clinic were provided by the Department of Health after December 1, 1941. Nursing supervision of the clinic was provided by the Community Service Society until October 1, 1942.

DATA AND METHOD OF STUDY

Detailed records concerning the social and economic condition of each family are being obtained and the families are visited at fairly frequent intervals for public health supervision and to note any changes in environmental conditions. The data which are particularly pertinent to this report are as follows:

Each month of the first year that the family was under public health nursing supervision a record was obtained indicating the amount of money spent for food during the previous week and the amount or frequency of use of the following foods:

- (1) Amount of milk
- (2) Number of eggs
- (3) Citrus fruits and kinds of other fruits
- (4) Green and yellow vegetables
- (5) Lean meats, fish, and poultry

It was believed that these records would reveal habits of the family with respect to the use of certain types of food and would indicate whether or not there were outstanding deficiencies in the quality of the diet. Where such deficiencies were noted the record was to serve as a guide for the need of intensive teaching in regard to the use of certain protective foods. These records were secured from each family at monthly intervals over a maximum period of twelve months.

The families included in this special study of food habits constitute a cross-section of the total families which have had nursing supervision since the program began on April 1, 1939. All families under supervision in December, 1941, have been included, provided the tuberculosis case which brought the family into the study was a member of the family and not a lodger in the household. Families in which the index case was a lodger, that is, a person unrelated to those responsible for the household unit, have been excluded.

In December, 1941, there were 215 families which fulfilled the

requirements for the study of food habits.^a A previous report on the special program has indicated that the tuberculous families under supervision in Upper Harlem are in certain respects fairly representative of the 8,500 households from which they are drawn.⁴ The average size of the household was the same as the average for the entire area, namely, 3.8 persons per household. The average amount of rent, \$33 per month, was somewhat lower than the average (\$37) for the area as a whole. The prevalence of crowding was greater in the tuberculous families. Twenty-four per cent of the 8,500 households had more than one person per room; 40 per cent of the families in the special study had more than one person per room.⁵

The qualitative food records secured from the family made it possible to grade the food habits of each family according to the extent of deviation from a dietary pattern prepared by the Committee on Food and Nutrition of the National Research Council which meets recommended frequency in the use of important food groups. The habits of use of each of the five types of food, (1) milk, (2) eggs, (3) citrus fruits and tomatoes, (4) green and yellow vegetables, and (5) lean meats, were classified according to the following categories: "excellent," "good," "fair," and "poor." The recommended dietary pattern used as a standard, and a detailed description of the content of the four categories for each food group, are shown in the Appendix. "Excellent" for the food items indicated a frequency of use equal to that recommended, and "good" was slightly below. "Fair" and "poor" described degrees considerably below recommended use of the food groups needed for the diet to be of good quality.

A combination of the ratings for each of the five types of food

^aIn a total of 229 families the tuberculosis case (index case) was a member of the family. Fourteen families were excluded because of refusal to give information concerning food habits.

⁴Downes, Jean and Price, Clara R.: The Importance of Family Problems in the Control of Tuberculosis. *The Milbank Memorial Fund Quarterly*, January, 1942, xx, No. 1, pp. 7-22.

⁵Data from the residential census, Real Property Inventory—City of New York—Borough of Manhattan, Residential Report, 1934.

make possible a composite rating of the quality of the dietary pattern of each family. This composite rating gives equal weight to each of the food groups considered and is described in the Appendix.

Before the data on use of different foods are discussed, it will be helpful to consider the significance of the recommended foods with reference to their contribution to a balanced diet with adequate amounts of various essential nutrients. Although some of the essential nutrients are distributed in nature in many different foods, several are present in appreciable amounts in only a few foods. An important example of the latter is ascorbic acid. Citrus fruits and tomatoes are very good sources of this vitamin, and although a few other foods also are moderately good sources, most diets will contain insufficient amounts of ascorbic acid unless a citrus fruit or tomato is included regularly in the diet. The vitamin A allowance can be obtained from various combinations of foods; nevertheless, a green or yellow vegetable of high vitamin A content usually is essential because it can be replaced satisfactorily only by an exceptionally large consumption of dairy products. The amount of milk daily which is recommended not only is needed to assure a good source of calcium and to supplement the vitamin A from vegetables, but also is almost indispensable for obtaining the amount of riboflavin which is considered necessary. Meat is the next best source of riboflavin, but some methods of cooking destroy a large percentage of the riboflavin, and only those who eat exceptionally large quantities of lean meat daily are likely to have an adequate amount of riboflavin unless milk is included in the diet. Meat is the best source of niacin (nicotinic acid). Thiamin is rather widely distributed in foods, but not in concentrated amounts. Milk, meat, and some vegetables are fairly good sources of thiamin, but there may be considerable loss from cooking. Eggs are not the most important source of any of the nutrients, but they are a good source of several vitamins as well as of iron and protein. The regular con-

sumption of eggs, therefore, is desirable as a supplement to other foods. Thus, it is apparent that a regular and adequate supply of the principal vitamins and minerals under most circumstances can be obtained best by the consumption each day of a green or yellow vegetable, a citrus fruit or tomato, two glasses of milk or equivalent, an egg, and a serving of lean meat. Whole grain cereal food or bread is important in the diet, but information as to its use was not included in this study. Other food combinations can be used to obtain complete nutritional protection, but as a rule, only very specially planned diets furnish all the necessary nutrients when these varieties of foods are not included. The total diet should include some foods not discussed, especially butter or fortified oleomargarine, and potatoes, and an amount of food sufficient to furnish the required energy value.

The records of foods used by the families studied contain mostly non-quantitative data. They show food choices of the family as a whole and indicate fairly well the possibility of certain dietary deficiencies. These facts should be stressed and kept in mind in the interpretation of the data presented in this study.

QUALITY OF THE FAMILY DIETS

It was considered of interest to see whether or not the dietary pattern of the families in Area 8 of Upper Harlem differed greatly from that of families living in other areas of Harlem. Consequently, qualitative food records for one week were secured for a sample population composed of 113 tuberculous families living in Central Harlem, Lower Harlem, and Area 7 of Upper Harlem. Table 1 shows the ratings on food habits of the families in Area 8 of Upper Harlem compared with the ratings of families from other parts of Harlem. On the whole, the distribution of the families according to their ratings on food habits was fairly similar for both groups. Seventy-one per cent of the families in Upper Harlem had food habits considerably below the recommended standard of frequency, compared with 77 per cent in that class in the other areas of Harlem.

CLASSIFICATION OF FAMILY DIET	PER CENT		NUMBER OF FAMILIES	
	Upper Harlem	Other Areas of Harlem	Upper Harlem ¹	Other Areas of Harlem
TOTAL FAMILIES	100.0	100.0	202	113
Excellent	9.4	5.3	19	6
Good	19.8	17.7	40	20
Fair	36.1	30.9	73	35
Poor	34.7	46.1	70	52

¹ Includes only families where a food schedule was obtained on the first visit to the family.

Table 1. Ratings on food habits for families in Upper Harlem compared with families in other areas of Harlem.

Relatively few families in either group had food habits which met the qualitative standard of adequacy. It is apparent that a high proportion of the tuberculous families in Harlem were in need of instruction concerning a diet of good quality.

The data for all families shown in Table 1 are based on food records for one week secured on the first visit to the family. For the rest of the analysis in this report the data are averages based on food records for two or three weeks. In some families instruction as to a proper diet was started at the time of the first visit, and improvement in food habits was noted on the second or third visit. Consequently, ratings based on averages of the first three months of supervision are somewhat better than the ratings based on records for the first visit only.

Table 2 shows the ratings of food habits for families in Upper Harlem according to size of family. Size of family is expressed in adult cost units. It is apparent that size of family did not affect the quality of food choices: 65 per cent of the families with one adult and one or two children, or two adults and one or no child (1.39-2.74 adult cost units) had a dietary pattern considerably below the recommended standard; 64 per cent of the families of larger size were in the same classes, that is, "fair" and "poor."

CLASSIFICATION OF RATINGS ON FOOD HABITS	TOTAL FAMILIES	SIZE OF FAMILY IN ADULT COST UNITS		
		1.00 OR LESS	1.39-2.74	2.75 and Over
TOTAL Excellent Good Fair Poor	PER CENT			
	100.0		100.0	100.0
	9.8		8.8	9.2
	26.0		26.5	26.6
	41.4		40.2	42.2
	22.8		24.5	22.0
	NUMBER			
	215	4	102	109
	21	2	9	10
	56	0	27	29
89	2	41	46	
49	0	25	24	

Table 2. Rating on food habits of 215 families at the time of the first visits to the family and according to size of family—Upper Harlem area of New York City.

Table 3 shows the distribution of the families according to the presence of the husband and wife in the household. In 204 families, or 95 per cent of the total, the wife was present; however, in 23 per cent she was ill or had recently been ill with tuberculosis. The husband was present in 145, or 67 per cent, of the total families; in 44, or 30 per cent of these families, he was ill or had recently been ill with tuberculosis.* It is apparent that in most of the families there was an adult who could take some responsibility for food habits of the family group.

The housewife is usually the one responsible for the kind of foods consumed by the family. Types of food and quantity of food which make up the family food supply, are also determined to a considerable extent by the amount of the family income that can be spent for food. On a low income where quantity of food is the first con-

*The husband or wife is counted as present in the household even though out of the household at some time during the period of study because of illness from tuberculosis.

CLASSIFICATION OF FAMILIES	PER CENT	NUMBER OF FAMILIES
TOTAL FAMILIES	100.0	215
Husband and Wife Present	63.3	136
Neither Tuberculous	28.4	61
Husband Tuberculous	19.3	41
Wife Tuberculous	14.7	32
Both Tuberculous	0.9	2
Wife Only Present	31.6	68
Not Tuberculous	26.1	56
Tuberculous	5.5	12
Husband Only Present	4.1	9
Not Tuberculous	3.6	8
Tuberculous	0.5	1
Neither Husband nor Wife Present	0.5	1
Single Individual	0.5	1

Table 3. Distribution of families according to the presence of the husband or wife in the household—Upper Harlem area of New York City.

sideration, the quality of the diet may suffer. Eighty per cent of the tuberculous families studied received some form of public assistance and many of the nonrelief families were living on incomes below the level considered adequate for maintenance. Furthermore, in some families the housewife was or had been ill with tuberculosis which, no doubt, affected her capacity as manager of the family food supply.

From the data presented showing food habits of the families, it is apparent that many families were in need of instruction concerning a good diet and advice in planning for the wisest use of the food budget. It is apparent also that some families were handicapped because of illness of the housewife. It will be of special interest to study the results of teaching in these families.

RESULTS OF EDUCATION AS TO FOOD HABITS

To appraise the results of teaching proper food habits in the families of Upper Harlem it is necessary to limit the number to families supervised for a period of ten to twelve months. Of the

total families under supervision in December, 1941, 166 were suitable for analysis of the results of nutrition teaching. The ratings on food habits of the families in the early part of the period of supervision can be compared with ratings for the same families at the end of the period. Qualitative ratings on two or three visits for each family at the beginning of supervision were averaged and used as a base line from which to measure change. At least six months of supervision must have intervened between the visits when data which constituted the basis for averages were obtained.

Table 4 shows the distribution of the 166 families according to the rating of food habits or dietary pattern of the family at the beginning of the period of supervision, compared with the ratings at the end of the period of study. Some improvement in the food habits of families is evident. The proportion with a dietary pattern equal to the suggested standard increased 58 per cent; those only slightly below the standard increased 40 per cent. The proportion of families with diets classed as "fair" or "poor" in quality decreased; and the most marked decrease was in the group of families with food habits classed as "poor," or very much below the recommended pattern.

Table 4. Comparison of first ratings of food habits of 166 families with ratings for the same families after a minimum of eight months' supervision—Upper Harlem area of New York City.

CLASSIFICATION OF RATINGS ON FOOD HABITS	PER CENT		NUMBER		PER CENT IN- CREASE OR DE- CREASE AT END OF PERIOD COM- PARED WITH FIRST PART OF PERIOD
	First Part of Period of Supervision	End of Period of Supervision	First Part of Period of Supervision	End of Period of Supervision	
TOTAL FAMILIES	100.0	100.0	166	166	—
Excellent	8.4	13.3	14	22	+58
Good	25.3	35.5	42	59	+40
Fair	41.6	38.6	69	64	-7
Poor	24.7	12.6	41	21	-49

Table 5 shows the families distributed according to the rating on each of the five types of food at the beginning and also at the end of the period of study. At the beginning of the period of supervision, deficiencies in the quality of the diet were noted most frequently for milk, lean meat, and green or yellow vegetables. With respect to citrus fruits and tomatoes, and eggs, 90 per cent of the families studied showed a frequency in their use equal to or only slightly below the frequency advocated for a good diet.

At the end of the period of supervision, improvement was noted in the use of all types of foods studied. However, there were still fifty-six families which used only two quarts of milk per person or less, per week; forty-five families classed as "fair" or "poor" in the use of lean meat; and twenty families which had green or yellow vegetables less frequently than is considered desirable.

In families of low-income status, most careful management of the budget is required in order to have a diet of good quality. Ratings on food habits of families, according to the average weekly amount spent for food during the first part of the period of nursing supervision, show that there is a relationship between the quality of the diet and the amount of money spent for food. These data are presented in Table 6. The families are divided into two groups: Those where the average weekly expenditure for food was equal to or more than the estimated amount required; and those where the weekly expenditure was less than the amount of money estimated as necessary to purchase a good diet.⁷

In the group of families where the amount of money spent on food was less than the amount considered sufficient, 88 per cent of the families had food habits rated either as "fair" or "poor," com-

⁷ The standard for the amount of money needed was obtained from the Table of Food Allowances, which is a part of the Schedule for Planning Budgets, issued by the Community Service Society for use by members of its staff. The Schedule for Planning Budgets is issued at intervals and takes account of changes in the cost of food and other items of living which are a part of the family budget. The Table of Food Allowances, dated July, 1941, was the one used as a standard for this study.

In computing the weekly amount of money needed for food, account was taken of the food requirements, by sex, of adults and of children of different ages.

CLASSIFICATION OF RATINGS ON FOOD HABITS	PER CENT		NUMBER	
	First Part of Period of Supervision	End of Period of Supervision	First Part of Period of Supervision	End of Period of Supervision
MILK				
TOTAL	100.0	100.0	166	166
Excellent	34.9	44.0	58	73
Good	19.9	22.3	33	37
Fair	27.7	27.7	46	46
Poor	17.5	6.0	29	10
EGGS				
TOTAL	100.0	100.0	166	166
Excellent	66.9	75.9	111	126
Good	22.9	22.3	38	37
Fair	7.2	1.2	12	2
Poor	3.0	0.6	5	1
CITRUS FRUITS AND TOMATOES				
TOTAL	100.0	100.0	166	166
Excellent	75.9	86.1	126	143
Good	14.5	8.4	24	14
Fair	3.0	2.5	5	4
Poor	6.6	3.0	11	5
LEAN MEAT				
TOTAL	100.0	100.0	166	166
Excellent	26.5	27.7	44	46
Good	36.7	45.2	61	75
Fair	34.4	25.3	57	42
Poor	2.4	1.8	4	3
GREEN OR YELLOW VEGETABLES				
TOTAL	100.0	100.0	166	166
Excellent	53.6	65.7	89	109
Good	24.1	22.3	40	37
Fair	17.5	9.0	29	15
Poor	4.8	3.0	8	5

Table 5. Comparison of first ratings on the use of five food groups recorded for 166 families with ratings for the same families after a minimum of eight months' supervision—Upper Harlem area of New York City.

CLASSIFICATION OF RATINGS ON FOOD HABITS	PER CENT		NUMBER	
	Amount Spent on Food Equal to or More Than Estimated Amount Needed	Amount Spent on Food Less Than Estimated Amount Needed	Amount Spent on Food Equal to or More Than Estimated Amount Needed	Amount Spent on Food Less Than Estimated Amount Needed
TOTAL FAMILIES	100.0	100.0	83	83
Excellent	15.7	1.2	13	1
Good	39.8	10.8	33	9
Fair	34.9	48.2	29	40
Poor	9.6	39.8	8	33

Table 6. Ratings of food habits of families according to average weekly amount spent for food during the first part of the period of nursing supervision—Upper Harlem area of New York City.

pared with 44 per cent in these two classes for the families where the food expenditure was considered satisfactory. It is apparent that a few families (ten) had food habits rated as of good quality even though the amount of money spent was less than that estimated for a good diet. It is also apparent that the expenditure of sufficient money for food does not necessarily insure a diet of good quality. It may be concluded from these data, presented in Table 6, that instruction as to wise expenditure of the money available for food was greatly needed in many families in both groups.

It is of interest to note changes in the quality of the food habits in the two groups of families after a period of nursing supervision. These data are presented in Table 7. Improvement in quality was most marked in the group of families where the average amount spent on food was less than the amount estimated for a diet containing good food choices. Evidently, these particular families received from the nurses more instruction and assistance in planning the food supply. Relatively little change was noted in the ratings of food habits for families which spent on the average the amount of money considered necessary.

CLASSIFICATION OF RATINGS ON FOOD HABITS	PER CENT		NUMBER	
	First Part of Period of Supervision	End of Period of Supervision	First Part of Period of Supervision	End of Period of Supervision
AMOUNT SPENT ON FOOD EQUAL TO OR MORE THAN ESTIMATED AMOUNT NEEDED				
TOTAL FAMILIES	100.0	100.0	83	83
Excellent	15.7	20.5	13	17
Good	39.8	42.2	33	35
Fair	34.9	27.7	29	23
Poor	9.6	9.6	8	8
AMOUNT SPENT ON FOOD LESS THAN ESTIMATED AMOUNT NEEDED				
TOTAL FAMILIES	100.0	100.0	83	83
Excellent	1.2	6.0	1	5
Good	10.8	28.9	9	24
Fair	48.2	49.4	40	41
Poor	39.8	15.7	33	13

Table 7. Comparison of first ratings of food habits of 166 families classified according to weekly amount spent for food with ratings for the same families after a minimum period of eight months' supervision—Upper Harlem area of New York City.

The data presented so far have shown that there was improvement in the food habits of some families during the period of nursing supervision studied. It is now of interest to examine the results of supervision from the point of view of the amount of dietary instruction given to the families by the nurses. The nurses' records of each of their visits to the 166 families afford data for classification of each family according to the frequency that instruction was given to the family.

The nurses' teaching has been classified according to the following categories: (1) Frequent instruction—instruction as to proper diet for the family recorded on at least one-half of the visits made to the family during the period of study. (2) Some instruction, but not frequent—instruction as to proper diet for the family recorded on

less than half of the visits made to the family during the period of study. (3) Instruction as to proper dietary to or for the patient only.

(4) No instruction as to food habits or proper diet recorded.

Improvement in food habits of the family can be brought about by instruction from the public health nurse. This is evident from Table 8 which shows the ratings at the beginning and at the end of supervision for the 166 families classified according to the frequency of the nurses' teaching during the period studied. In the families where emphasis was placed upon instruction as to a proper diet, the number classed as "excellent" or "good" increased 33 per cent. This was from approximately three to five times as great an

Table 8. Comparison of first ratings on food habits of 166 families classified according to the amount of dietary instruction given by the nurses with ratings for the same families after a minimum period of eight months' supervision—Upper Harlem area of New York City.

CLASSIFICATION OF PERIOD OF STUDY	TOTAL FAMILIES	CLASSIFICATION OF FAMILY DIETARY PATTERN				INCREASES IN PER CENT RATED EXCELLENT OR GOOD
		Excellent	Good	Fair	Poor	
At Beginning of Supervision At End of Period of Supervision	FREQUENT INSTRUCTION					
	42	12	7	17	6	33.3
	42	18	15	7	2	
	SOME INSTRUCTION BUT NOT FREQUENT					
	44	1	11	17	15	6.8
	44	2	13	25	4	
	INSTRUCTION TO OR FOR PATIENT ONLY					
	36	0	13	14	9	5.6
	36	1	14	14	7	
	NO INSTRUCTION RECORDED					
44	1	11	23	9	13.6	
44	1	17	19	7		

increase in these classes as was noted in the families in any of the other categories where less or no instruction was given. It is apparent that dietary teaching to or for the patient only had little or no effect upon the family dietary pattern. Only two families out of thirty-six in this group showed improvement. Where little instruction was given for the family as a whole, the per cent shifted to a higher rating class was not appreciably different from those families where no dietary instruction was recorded as given.

From the data in Table 8 it is also apparent that the nurses did not always select for frequent instruction as to a proper diet those families most in need of such instruction. For example, at the beginning of the period of supervision there were thirty-nine families with food habits rated as "poor." Only six of these families were in the group given frequent instruction.

The question may be raised as to whether families of very low income and, thus, those most in need of advice from the nurse as to wise food choices, were concentrated among the families supervised by only one or two nurses. The proportion which received some public assistance may be taken as one index of economic status; and the proportion where average food expenditure was less than the adequate amount required, may be used as another. The distribution of families by nurse is shown for each of these indices in Tables

Table 9. Distribution of 166 families according to nursing district and receipt of some form of public assistance—Upper Harlem area of New York City.

CLASSIFICATION OF FAMILIES	ALL NURSES	NURSE				
		A	B	C	D	E
TOTAL FAMILIES	166	33	29	38	35	31
No Public Assistance	53	9	9	11	15	9
Received Some Public Assistance	113	24	20	27	20	22
Per Cent Received Some Public Assistance	68.1	72.7	69.0	71.1	57.1	71.0

CLASSIFICATION OF FAMILIES	ALL NURSES	NURSE				
		A	B	C	D	E
TOTAL FAMILIES	166	33	29	39	35	31
Average Amount Spent on Food Equal to or More Than Estimated Amount Needed	83	18	17	17	14	17
Amount Spent on Food Less Than Estimated Amount Needed	83	15	11	21	21	14
Per Cent Spent Less Than Estimated Amount Needed	50.0	45.5	41.4	53.8	60.0	45.2

Table 10. Distribution of 166 families according to the average weekly amount spent on food and according to nursing district—Upper Harlem area of New York City.

9 and 10, respectively. From 69 to 73 per cent of the families supervised by each of four nurses received some public assistance (Table 9). In the case of one nurse, Nurse D, 57 per cent of the families had public assistance. Table 10 shows no great differences between the five groups with respect to the proportion which had food expenditures less than the amount considered necessary for an adequate diet. The variation in performance of the nurses with respect to dietary education as recorded for the family cannot be attributed to any concentration in a particular nursing district of families in greatest need of instruction.

SUMMARY AND CONCLUSIONS

The significant points brought out by this study are as follows:

A relatively high proportion of the tuberculous families in Upper Harlem had food habits considered as unsatisfactory and probably indicative of certain dietary deficiencies. Less than 10 per cent of the families studied had dietary patterns corresponding to a recommended standard. Seventy-one per cent were considerably below the standard pattern believed necessary for the maintenance of good

health. After a period of supervision, 51 per cent were in that class.

Perhaps the most important point brought out by the study is that improvement in food habits can be obtained in families under public health supervision where sufficient emphasis is placed upon teaching what constitutes a good diet. Measures for the preservation of good health and for increasing resistance to infection are especially important for family members who have been exposed to tuberculosis. Consequently, teaching with regard to a good dietary pattern for these families may be considered a proper function of the public health nurse.

Another point of some interest is that routine teaching as to the need for a good diet for the tuberculous patient has little or no effect upon the family dietary pattern. The data presented in this study afford only a small sample, but the result shown by the sample seems logical. The tuberculous patient is sick, and recommendations for the treatment of the sick usually are not interpreted as applying to the apparently well. In these families there is an unusual opportunity to teach a preventive measure for the entire family as well as a therapeutic measure for the patient.

APPENDIX

Description of qualitative classes used in rating weekly food records.

1. *Rating for Milk Used per Person per Week*

- Excellent — 4 quarts or more
- Good — 3 quarts
- Fair — 2 quarts
- Poor — 1 quart or less, no milk used, or unknown amount

2. *Rating for Eggs per Person per Week*

- Excellent — 5 or 6 or more eggs
- Good — 3 or 4 eggs
- Fair — 2 eggs
- Poor — 1 or no eggs

3. *Rating for Times Citrus Fruits and Tomatoes Used per Week*

- Excellent — 6 or 7 times or more per week

- Good — 4 or 5 times
- Fair — 3 times
- Poor — 2, 1, or no times per week
- 4. *Rating for Times Yellow or Green Vegetables Used per Week*
 - Excellent — 7 times or more per week
 - Good — 5 or 6 times
 - Fair — 3 or 4 times
 - Poor — 2, 1, or no times
- 5. *Rating for Times Lean Meat Used per Week*
 - Excellent — 7 times or more per week
 - Good — 5 or 6 times
 - Fair — 2, 3, or 4 times
 - Poor — 1 or no times
- 6. *Composite Rating for Five Food Groups*
 - Excellent — 5 ratings excellent
 - Good — 5 ratings excellent or good
 - Fair — 1 or more ratings fair, no rating poor
 - Poor — 1 or more ratings poor

The dietary "pattern" to meet recommended allowances outlined by the Committee on Food and Nutrition, National Research Council, is as follows:

- Milk—adults—1 pint daily; children—1 quart daily
- Vegetables—2 servings daily—1 green or yellow
- Fruit—2 servings—1 citrus or tomato daily and 1 other
- Eggs—3 or 4 times per week
- Meat—1 serving daily
- Whole grain or "enriched" cereal and bread—at least half of the intake
- Butter or fortified oleomargarine (100-500 calories)
- Potato—1 or more servings daily

LIFE TABLES FOR SOCIAL CLASSES IN ENGLAND

CHRISTOPHER TIETZE, M.D.¹

ONE of the pioneer accomplishments of Dr. William Farr was the first general tabulation of male deaths by occupation and age published in England by the Registrar-General in the report² for 1851. Subsequently such studies have been made in connection with every decennial census, usually for the three years centered around it. There has been a steady improvement both in scope and in quality which has made these reports a most valuable source of material for medical statisticians everywhere. The latest volume covering the triennium 1930 to 1932³ was issued shortly before the outbreak of World War II. No census was taken in England in 1941. The next enumeration is due in 1951 and if it is not advanced to an earlier date new information on occupational mortality will not be available for another fifteen years. The data now at hand are therefore of unusually lasting interest.

In addition to publishing mortality rates for individual occupations the Registrar-General has also combined them for major social classes. The present paper is an attempt to summarize this latter type of information in the form of abridged life tables. In order to do so certain assumptions had to be made which will be described. It cannot be claimed, therefore, that these life tables are absolutely exact, but it is felt that they give a fairly accurate picture of class differences in mortality in England around 1931.

The Decennial Supplement gives in Table 4A census populations, numbers of deaths, and mortality rates for occupied and retired males in nine age groups—16 to 19, 20 to 24, 25 to 34, 35 to 44,

¹ The Johns Hopkins University School of Hygiene and Public Health.

² Fourteenth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England. London, 1855.

³ The Registrar-General's Decennial Supplement, England and Wales, 1931, Part IIa, Occupational Mortality. London, 1938.

45 to 54, 55 to 64, 65 to 69, 70 to 74, and 75 and over. Table 14 presents births, deaths under one year, and infant mortality for legitimate children by social class of father within occupational groups, and Table 17 has similar information for children between one and two years of age. The report also contains data on the mortality of married women by occupation of husband and of single women but not of widows and divorcees. This study is, therefore, confined to the male sex.

Table 1 of this paper presents the numbers of occupied and retired males aged 16 and over assigned to each social class. The original grouping of the Registrar-General has been deviated from in three points. Farmers, gardeners, agricultural laborers, and several categories of coal miners have been removed from Classes II, III, IV, and V, and appear as two separate classes. This was done because, as will be seen, the agricultural workers as a group have a very low and the coal miners a very high mortality and both groups are large enough to influence seriously the death rates of any class in which they are included. Furthermore both new classes are fairly homogeneous and quite interesting in their own right. The third deviation consists in the transfer of almost 700,000 clerks from Class III to Class II because it is felt that these white-collar workers should be combined with the employers, managers, and officials into whose

Table 1. Occupied and retired males, 16 and over, and per cent distribution by social class. England and Wales, 1931.

SOCIAL CLASS	MALES 16 AND OVER	PER CENT
I (Professional, etc.)	335,182	2.5
II (Intermediate between I and III) ¹	2,211,533	16.2
III (Skilled Workers)	5,313,129	38.9
IV (Intermediate between III and V)	1,560,583	11.4
V (Unskilled Workers)	2,239,738	16.4
Farmers, Gardeners, Agricultural Laborers	1,117,281	8.2
Coal Miners	868,523	6.4
TOTAL	13,645,969	100.0

¹ Almost 90 per cent of Class II are employers and managers in business and clerical workers.

ranks many of them will ultimately advance. It may be mentioned in passing that they had been counted in Class II by the Registrar-General in the preceding report⁴ covering the years 1921 to 1923.

To make the social class life tables comparable to life tables for the general population it appears desirable to have them include all children born in and out of wedlock. Data on illegitimate births are available only by occupation of mother⁵ and this tabulation is not very useful because 40 per cent of unmarried mothers were indoor domestic servants and 29 per cent without gainful employment. There is some reason to believe that the fathers of illegitimate children are spread much more evenly over the social classes. It was, therefore, decided to increase the death rate of legitimate male infants in each social class at a uniform ratio to allow for the higher mortality of the illegitimates. Only 4.5 per cent of all children were born out of wedlock in 1931 and the rates had to be increased by only 3.3 per cent. Following the same line of reasoning the mortality rates for legitimate male children between one and two years were uniformly increased by .9 per cent. Actually illegitimate births are more common on lower than on higher social levels, but the error introduced by the choice of a uniform ratio of increase is negligible.

No actual information is available for the years between the second and sixteenth birthday. Mortality, however, reaches its minimum during this period and the life table for the general population⁶ gives for the male sex a probability of dying of only .0351 in fourteen years. Total removal of mortality in this age group would increase the complete expectation of life at birth by less than two years, doubled mortality rates would reduce the expectation by a somewhat smaller amount. It was, therefore, considered justifiable

⁴The Registrar-General's Decennial Supplement, England and Wales, 1921. London, 1927.

⁵Footnote 2, Table 15.

⁶The Registrar-General's Decennial Supplement, England and Wales, 1931, Part I, Life Tables. London, 1936.

to substitute reasoned guesswork for knowledge and to let the mortality of each social class deviate just half as much from the national average between two and sixteen years as was observed during the first two years of life. This assumption puts the mortality of Class I at 76 per cent, that of Class V at 115 per cent of the rate for all males and it is felt that it tends to reduce rather than overstate class differentials in mortality.

A further adjustment had to be made in the higher age groups. It has been known for some time "that statement on the Census Schedule of the former occupation of retired males tends to be omitted as life advances, whereas in death registration statement of the last occupation has nearly always been obtained, and the result is that at ages after 60 the population returned as never occupied is too large, and the populations of the occupied (and retired) are too small, to correspond with the deaths similarly classified."⁷ This makes mortality rates at advanced ages appear spuriously high. The extent of the discrepancy can be estimated with great accuracy for the aggregate of all occupied and retired males. The mortality rate was reduced by .68 per cent for the decade 55 to 64 years, by 2.91 per cent from 65 to 69, by 6.18 per cent from 70 to 74, and by 11.24 per cent at 75 and over. These ratios were applied uniformly to all social classes.

The necessary adjustments of mortality rates having been made, abridged life tables were constructed by a combination of the Reed-Merrell method⁸ and that described by R. R. Kuczynski.⁹ Table 2 presents the numbers of survivors at exact ages and the complete expectation of life at birth. A radix of 1,000 rather than of 100,000 has been used and the expectation given to one decimal only in order to avoid the illusion of pseudo-accuracy. Data from the official

⁷ Footnote 2.

⁸ Reed, L. J. and Merrell, M.: A Short Method for Constructing an Abridged Life Table. *The American Journal of Hygiene*, September, 1939, 30, No. 2, Sec. A, pp. 33-62.

⁹ Kuczynski, Robert R.: *THE MEASUREMENT OF POPULATION GROWTH*. New York, Oxford University Press, 1936.

AGE	I	II	III	IV	V	FARMERS, ETC.	COAL MINERS	ALL MALES
	Profes- sional, Etc.	Inter- mediate Between I and III	Skilled Workers	Inter- mediate Between III and V	Un- skilled Workers			
SURVIVORS AT EXACT AGES								
0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	100,000
1	961	947	935	924	910	938	905	92,814
2	956	941	924	910	890	930	886	91,394
16	930	913	893	877	854	900	850	88,186
20	916	904	885	868	845	894	838	87,245
25	901	891	871	854	830	882	822	85,824
35	876	865	843	824	799	858	789	82,885
45	838	822	800	771	747	824	739	78,357
55	759	738	719	677	654	762	658	70,041
65	605	576	568	520	503	641	518	54,899
70	484	450	451	402	391	538	400	43,361
75	349	303	312	264	258	402	264	29,665
COMPLETE EXPECTATION OF LIFE AT BIRTH								
0	63.1	60.8	60.0	57.3	55.7	63.0	55.7	58.74

Table 2. Survivors at exact ages and complete expectation of life at birth. Life tables for males by social class, England and Wales, 1930 to 1932.

English Life Table No. 10⁸ for the years 1930 to 1932 are added for comparison.

Let us first turn to the data on complete expectation of life at birth. The five social classes designated by numerals present a very regular gradient. The expectation of life for agricultural workers appears virtually identical with that of Class I and the coal miners show the same value as do unskilled workers. The difference between the maximum and minimum values is 7.4 years. This is a little more than the increase in expectation of life observed in England as a whole between 1911 and 1931. Expressed in terms of European countries the difference is almost as large as between Scotland and Poland or between Denmark and Italy.

An interesting phenomenon is revealed by a more detailed comparison between Class I and the agricultural workers. The numbers of survivors are definitely higher for Class I in youth and early adult life but later the advantage shifts to the agricultural group. It seems that well-educated and well-to-do parents are most successful in preventing deaths among their children but that the people on the farms are either of sturdier stock or their mode of life is in the long run healthier.

In interpreting Table 2 the somewhat abstract nature of the figures should not be lost sight of. The life table technique has been applied to social classes which are not closed populations. Sons of professional men or coal miners do not always follow the careers of their fathers and also in later life shifts from one occupation to another across class lines are not uncommon. Such transfers, however, occur also between some of the geographical units for which life tables are customarily computed.

SUMMARY

Abridged life tables for males of seven large social classes are constructed from English mortality statistics for 1930 to 1932. The complete expectation of life at birth is found to range from 63 years for the highest class and agricultural workers to less than 56 years for unskilled workers and coal miners.

VARIATION IN NURSING SERVICE WITH FAMILY INCOME AND SIZE OF CITY

BASED ON RECORDS FOR 9,000 FAMILIES IN EIGHTEEN STATES VISITED
PERIODICALLY FOR TWELVE MONTHS, 1928-1931¹

SELWYN D. COLLINS²

THERE is an acute shortage of adequately trained nursing personnel. When the needs of the Armed Forces are satisfied, the remaining nurses can meet urgent civilian needs only if their services are distributed among the various elements of the population on the basis of need for care.

Full-time private nursing service is now distributed among the different economic levels like a luxury; the higher income brackets get the most care and the poor get very little. However, visiting nursing goes largely to low-income levels. The situation with respect to all nursing is not unlike that of hospital care—the rich and poor get more nursing than the middle-income groups. This paper presents some quantitative data on the distribution of nursing service of the several kinds among families of different economic levels in urban and rural areas.

SOURCE AND CHARACTER OF DATA

In the study of illness in a group of families in eighteen States

¹ From General Morbidity Studies, Division of Public Health Methods, National Institute of Health.

This is the twenty-first of a series of papers on sickness and medical care in this group of families (1-20). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness and the extent and kind of medical care, without regard to costs. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some overlapping. The Committee staff, particularly Dr. I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

Special thanks are due to Dr. Mary Gover and Miss Clara E. Councell who assisted in the analysis, and to Mrs. Lily Vanzee Welch and Mrs. Dorothy Oliver who were in charge of tabulating the data.

² Principal Statistician, United States Public Health Service.

that was made by the Committee on the Costs of Medical Care (21) and the United States Public Health Service,³ the record for each illness included a statement of the nursing days and visits received within the twelve-month study period.

The composition and characteristics of the group of 8,758 white families which were kept under observation for twelve consecutive months in the years 1928-1931 have been considered in some detail in the first report in the series (1). These families, including a total of 39,185 individuals, resided in 130 localities in eighteen States representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas.⁴ With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

Each family was visited at intervals of two to four months for a period long enough to obtain a sickness record for twelve consecutive months. On the first call a record was made of the number of members of the household, together with sex, age, and other facts about each person. On succeeding visits the canvasser recorded all illness that had occurred since the preceding call, with such pertinent facts about each case as the date of onset; total duration of symptoms, of disability, of confinement to bed and to a hospital; whether attended by a doctor; and the nature and extent of nursing service received. Records for persons who were still sick at the preceding visit were brought up to date and when completed the termination of the case was entered. Thus there are available for an

³The eighteen States sampled and the number of canvassed families were as follows: California (890), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (494), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (1).

⁴Every community that was included in the study had either a local health department or some other organization employing a visiting nurse or both; therefore, the most rural areas with no organized community services are not represented.

observed population, which may be classified by family income and size of city of residence, the number and proportion of illnesses that had nursing service and the days and visits received.

Definition of Illness and Diagnosis Classification. An illness, for the purpose of this study, was defined as any symptom, disorder, or affection which persisted for one or more days or for which medical service⁶ was received or medicine purchased. Illness included the results of both disease and injury. What was actually included as illness, however, was necessarily influenced not only by the informant's conception of sickness but also by her memory. With visits as infrequent as two to four months, it was inevitable that many of the unattended nondisabling illnesses would be terminated and forgotten before the next visit of the enumerator.

The diagnosis as reported by the family informant was submitted to the attending physician for confirmation or correction and his diagnosis substituted for the one given by the family. While reports could not be obtained from all attending physicians, the replies indicated that the housewife usually reported with reasonable accuracy the diagnosis which the physician had given to the family.⁷

Considering an illness in the sense of a continuous period of sickness, only 4.3 per cent were designated as due to more than one cause. In general, the more important or more serious cause was assigned as primary, except where a disease like pneumonia is commonly recognized as following measles or influenza, in which case the antecedent condition was taken as primary.⁸ In the present paper only five important diagnoses are shown separately and they refer always to the sole or primary diagnosis of the illness.

Definition of Nursing Service. Nursing service included all care of illness by *private* graduate and practical nurses within or outside

⁶ Exclusive of dental services, eye refractions, immunizations, and health examinations rendered when no symptoms were present.

⁷ See comparison of diagnoses reported by families and by physicians in the Health Survey of 1935-36 (24, Table 2).

⁸ Further details on the method of classifying the causes of illness are included in the first report in the series (1).

of hospitals, and also care by visiting nurses from all types of organizations such as health departments, industrial establishments, and insurance companies. It was assumed that private or special nursing in hospitals was all done by trained nurses designated here as graduate. With the exception of the table in footnote 14, nursing by general duty hospital nurses is not included in any nursing category used in this paper. The services of maids and other servants are not counted as nursing even when procured because of the illness.

Patients in institutions for the chronically sick have little *private* nursing. Moreover, many such patients have ceased to be considered as members of the family from which they came, so are unreported in family surveys. Since the completeness of such reporting⁹ may vary with income and city size, the data in this paper are exclusive of cases in institutions for mental diseases, tuberculosis, and the resident care of other chronic diseases for part or all of the study year.¹⁰ Thus the present study is limited to nursing in the home and *private* nursing in such hospitals as general, women's, children's, eye-ear-nose-throat, and communicable or isolation.

Of more importance than nursing in institutions for tuberculosis and for mental and other chronic diseases is the exclusion of eight nursing cases with so many days of care (each with the equivalent of eight months or more of the study year) as to raise doubt as to whether all of the service should be classified as nursing.¹¹ While the eight cases constituted less than 1 per cent of all private nursing

⁹ See preceding papers (18, 14) for discussion of family sickness surveys in relation to patients in resident institutions.

¹⁰ Of the total of 907 private duty nursing cases with 15,898 nursing days, there were six cases with 111 private nursing days rendered within such institutions. Of the total of 1,213 visiting nurse cases, twenty-one were institutional patients visited either before or after the period of hospitalization.

¹¹ See preceding paper (20) for detailed statement on each of the eight long cases. These eight cases with 2,541 nursing days (shifts) were distributed by family income as follows: \$2,000-3,000, one case, 364 days; \$3,000-5,000, three cases, 770 days; \$5,000 and over, four cases, 1,407 days. With respect to size of community they were distributed as follows: towns under 5,000, four cases, 1,204 days; cities 5,000-100,000, one case, 336 days; cities over 100,000, three cases, 1,001 days.

cases, they were responsible for 16 per cent of the nursing days. These eight cases are excluded from all rates and averages involving days but are included in all case rates and percentages that are based on cases.

A day of nursing care refers to the service of one nurse during one shift or period of nursing; thus a case with both a day and a night nurse would count as two days of nursing for each calendar day that such service was continued. On the other hand, if only one nurse was employed, the calendar day was counted as only one day of nursing even though the hours were exceptionally long. The data were not recorded so that exact hours could be counted.

In computing nursing cases per 1,000 population for the year, illnesses that originated prior to but had nursing service within the study year are included, along with nursing cases which had their onset within the period of observation; the inclusion of illnesses with prior onset seemed necessary to give proper representation to chronic ailments. The only date of onset available was that of symptoms (nondisabling or disabling); therefore, prior onset of a case does not necessarily mean that the nursing service began prior to the study year. Seven per cent of the attacks of illness had their onset of symptoms prior to the study year but the percentage in which the nurse began her work prior to the year of observation was presumably smaller.

In computing private duty and visiting nursing rates and percentages, a case with both types of nurses is counted in both categories, but it is counted only once in computing rates for nurse of any kind.²¹

²¹ Throughout this paper nursing case and day rates for all causes of illness are adjusted to the age distribution of the white population of the United States in 1930. The *indirect* method of adjustment which was used is described in a footnote to Table 3. One of the disadvantages of this method is that adjusted rates for two or more subcategories do not necessarily add to the adjusted rate for the total. However, to avoid inconsistencies as well as additional labor, the following procedures were used: (a) Since surgical and nonsurgical cases add to the total, the age adjustment was made for the total and nonsurgical rates only, surgical being obtained by subtraction. (b) Age adjustments were made for rates for "all private nursing" and "graduate nurse" but "practical nurse only" was obtained

(Continued on page 193)

Nursing days and visits refer in all instances to those *within the twelve-month study period*. In computing averages per case, both complete and incomplete cases are included as cases but the days and visits refer to those within the study year only. Nursing cases with an unknown number of nursing days or visits were put in at the average per case of the same diagnosis.

NURSING FOR ILLNESS FROM ALL CAUSES

Nursing care is not generally considered a necessity except in the most severe illnesses. Partly because of this fact there is no feeling on the part of any section of the general public that a nurse has any obligation to serve those who are unable to pay. Since the services of a full-time professional nurse are rather expensive, it might be expected that such nursing would be largely concentrated in the upper income groups.

Family Income. Figure 1 shows for five income groups private duty nursing rates per 1,000 population in terms of cases and days of nursing care, together with the percentage of all illnesses that had a private nurse (Table 1). All three of these measures indicate much more nursing in the higher income groups than in the lower. In nursing cases the rate for the highest group (\$5,000 and over) is more than seven times that for the lowest (under \$1,200); in nursing days per 1,000 population the rate for the highest group is more than thirteen times that for the lowest. However, in nursing

by subtraction. (c) Cases with private nurse and with visiting nurse add to the total with "nurse of any kind" only when no case had both types of nurses. When there were no such duplicates, the adjusted rate for "nurse of any kind" was obtained by the addition of the adjusted rates for the two types of nurses. Where there were cases with both types of nurses, all three rates were adjusted independently, but it was assumed that the sum of the adjusted rates for private duty and visiting nursing should be equal to or exceed the adjusted rate for "nurse of any kind," as would be true of crude rates. Minor changes in the rates for "nurse of any kind" to comply with this assumption were made in seven of the total of forty-two adjusted rates for nurse of any kind; in six of the seven instances the change was less than unity, and in no case was the general picture of nursing in the different income or urban-rural classes modified in any way.

No adjustment for age differences has been made in rates for specific diagnoses.

Percentages of cases and nursing days per case are based on actual cases and days with no adjustment for age. In some preceding papers "adjusted" percentages were computed by relating two adjusted rates instead of using actual numbers of cases, and "adjusted" days per case by relating adjusted rates for days and cases.

ANNUAL FAMILY INCOME AND KIND OF NURSE	ALL AGES ¹		AGE									
	Number of Cases or Days		Adjusted ² Rate		Under 20		20-44		45 and Over			
	Surgical	Non- surgical	Total	Surgical	Non- surgical	Surgical	Non- surgical	Surgical	Non- surgical	Surgical	Non- surgical	
NURSING CASES PER 1,000 POPULATION DURING YEAR												
<i>Private Duty³</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	14	37	10.1	2.7	7.4	1.6	1.9	2.6	2.8	11.9	4.5	11.2
	69	129	17.0	5.8	11.2	1.9	3.9	3.9	8.3	18.6	9.4	8.1
	70	116	22.3	8.1	14.2	3.9	10.7	10.7	17.4	23.2	10.8	12.3
	60	77	30.5	13.0	17.5	8.9	8.0	17.4	17.4	21.1	9.4	23.4
	145	175	73.8	32.1	41.7	33.5	34.6	30.5	30.5	38.9	26.0	40.7
<i>Visiting</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	37	267	51.2	6.1	45.1	7.3	36.6	7.4	7.4	76.8	1.1	19.9
	40	457	35.0	2.8	32.2	3.0	31.3	3.5	3.5	44.4	1.3	15.0
	26	213	24.3	2.6	21.7	2.4	23.1	3.1	3.1	24.9	3.1	13.9
	10	66	15.4	2.0	13.4	.9	13.1	3.2	3.2	14.3	2.3	12.9
	4	51	12.4	.9	11.5	—	6.6	1.2	1.2	10.8	1.7	18.2
<i>Nurse of Any Kind</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	50	208	61.3	8.8	52.5	8.9	38.2	9.7	9.7	85.9	5.6	30.2
	105	553	50.1	8.6	41.5	4.9	34.3	11.3	11.3	57.4	10.0	21.9
	88	302	42.5	9.9	32.6	6.3	26.6	12.4	12.4	41.8	11.5	23.9
	64	135	41.9	13.5	28.4	8.9	20.6	19.0	19.0	33.3	10.5	32.7
	147	219	83.1	32.9	50.2	33.5	41.2	30.5	30.5	47.3	27.7	56.3
PERCENTAGE OF ALL CASES ⁴ THAT HAD NURSE OF SPECIFIED KIND												
<i>Private Duty³</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	298	4,287	1.1	4.7	.9	2.7	.3	6.3	1.7	11.1	1.3	1.3
	733	9,961	1.9	9.4	1.3	3.2	.5	15.1	2.7	27.8	1.2	1.2
	651	7,160	2.4	10.8	1.6	5.2	.5	16.2	3.5	21.2	1.8	1.8
	314	3,998	3.2	19.1	1.9	12.3	.9	25.6	2.9	25.8	3.0	3.0
	416	4,464	6.6	34.9	3.9	29.9	3.0	38.1	4.7	41.1	4.7	4.7
<i>Visiting</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	298	4,287	6.6	12.4	6.2	12.6	5.0	16.5	11.1	2.8	2.3	2.3
	733	9,961	4.6	5.5	4.6	5.1	3.9	6.4	6.4	3.7	2.2	2.2
	651	7,160	3.1	4.0	3.0	3.1	2.8	4.7	3.7	6.1	2.0	2.0
	314	3,998	1.8	3.2	1.7	1.3	1.5	4.7	2.0	6.5	1.6	1.6
	416	4,464	1.1	1.0	1.1	—	.6	1.5	1.3	2.7	2.1	2.1
<i>Nurse of Any Kind</i> Under \$1,200 \$1,200 but Under \$2,000 \$2,000 but Under \$3,000 \$3,000 but Under \$5,000 \$5,000 and Over	298	4,287	7.6	16.8	7.0	15.3	5.2	21.5	12.4	13.0	3.5	3.5
	733	9,961	6.2	14.3	5.6	8.3	4.3	20.4	8.3	29.6	3.3	3.3
	651	7,160	5.0	13.5	4.3	8.3	3.2	18.7	6.2	22.7	3.4	3.4
	314	3,998	4.6	30.4	3.4	12.3	2.3	27.9	4.6	29.0	4.2	4.2
	416	4,464	7.5	35.3	4.9	20.9	3.6	38.1	5.1	43.8	4.8	4.8

Table 1. Nursing service for all causes of illness among canvassed white families of different income levels in eighteen States during twelve consecutive months, 1928-1931.

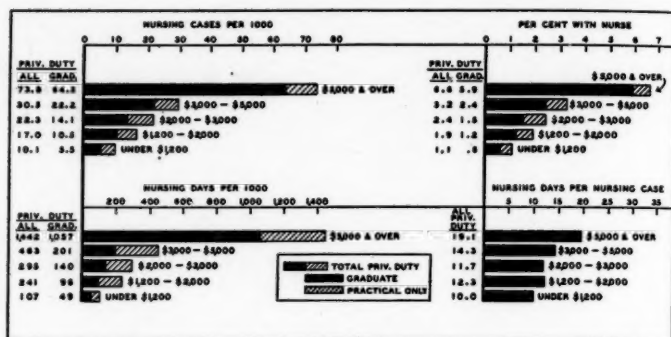


Fig. 1. Annual frequency of graduate and practical private nursing cases and days among persons of all ages in families of different income levels in eighteen States during twelve consecutive months, 1928-1931 (age adjusted rates per 1,000 population and percentages of all cases that had a nurse.)

days per case the average for the highest income is less than twice that for the lowest group. The percentage of the total cases in the highest income group that had a full-time private duty nurse was six times that in the lowest; this ratio was approximately the same for the percentage of disabling and also of hospital cases that had a private nurse.¹⁸

The bars in Figure 1 are hatched in a way to show separately the data for graduate and practical nurses. The great majority of the nursing was done by trained or graduate nurses. The relative differences between the income groups were considerably greater for graduate than for practical nurses. However, even practical nursing increased with income. In graduate cases per 1,000 population the rate for the highest income group was nearly twelve times that for the lowest; the rate for practical nursing cases for the highest income level was about twice that for the lowest.

As might be expected, the percentage of nursing cases and days that were graduate increased considerably with income (Table 2). Of all private nursing cases 75 per cent had a graduate nurse; this

¹⁸ The percentages of hospital cases that had a private nurse in the hospital were: under \$1,200, 6.9; \$1,200-2,000, 13.0; \$2,000-3,000, 15.9; \$3,000-5,000, 25.3; \$5,000 and over, 47.5 per cent.

ANNUAL FAMILY INCOME	PERCENTAGE DONE BY GRADUATE NURSE						TOTAL NUMBER OF CASES WITH PRIVATE NURSE	
	PRIVATE NURSING CASES				NURSING DAYS			
	All Causes			Deliveries and Abortions	All Causes	Deliveries and Abortions	All Causes	Deliveries and Abortions
	Total	Surgical	Non- surgical					
ALL INCOMES ¹	75	98	59	43	62	40	901	226
Under \$1,200	57	100	41	26	48	10	51	19
\$1,200 but Under \$2,000	63	100	43	28	44	18	198	75
\$2,000 but Under \$3,000	65	96	47	35	53	16	186	65
\$3,000 but Under \$5,000	74	90	62	61	47	48	137	33
\$5,000 and Over	90	100	82	84	79	87	320	32

¹ All incomes includes a few of unknown income.

Table 2. Percentage of private duty nursing that was done by graduate nurses among canvassed white families of different income levels during twelve consecutive months, 1928-1931.

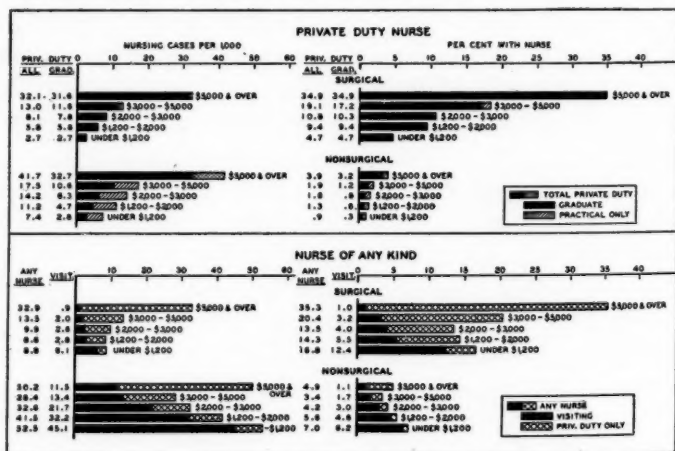
percentage increased from 57 for the lowest income group (under \$1,200) to 90 for the highest (\$5,000 and over). Corresponding proportions of private nursing days that were graduate ranged from 48 per cent for the lowest to 79 for the highest income group. Nearly all of the surgical private nursing cases had a graduate nurse but for nonsurgical cases with a private nurse, the proportions that had a graduate nurse ranged from 41 per cent for the lowest to 82 per cent for the highest income group. Deliveries, which accounted for a considerable part of private nursing, showed great variation in the proportions of nursing cases that were graduate, ranging from 26 for the lowest to 84 per cent for the highest income group; corresponding percentages for nursing days that were graduate ranged for deliveries from 10 per cent for the lowest to 87 for the highest income group.

Visiting nursing is about as largely confined to the low-income groups as private nursing is confined to the higher incomes (Table 1). The visiting nurse case rate for the lowest income level is about four times that for the highest. When all nursing is considered to-

gether (private duty and visiting), the lowest and highest income groups have more nursing than intervening groups. Nursing in the high-income group is largely private duty and that in the lowest group is largely visiting. The intervening groups, particularly \$2,000 to \$5,000 in annual family income, have the lowest nursing case rates. The same general situation is indicated by the percentage of all and of disabling cases which were attended by a nurse of any kind.

Figure 2 shows by income data for surgical and nonsurgical cases separately. On the left of the figure are nursing cases per 1,000 population and on the right the percentage of cases that had a nurse of the given kind. The bars for private duty nursing are hatched in a way to show graduate nursing as a separate category. For full-time private nursing the rates for surgical cases are of the same order of magnitude as for nonsurgical, although the latter are somewhat higher in every income group. In percentages, however,

Fig. 2. Annual frequency of various kinds of nursing for surgical and nonsurgical cases among persons of all ages in families of different income levels in eighteen States during twelve consecutive months, 1928-1931 (age adjusted rates per 1,000 population and percentages of all cases that had a nurse.)



the surgical cases have the attendance of a nurse in a much larger proportion of cases than is true of nonsurgical. In both case rates and percentages with a private nurse there are consistent and large increases in nursing as family income increases. In surgical cases nursing by a practical nurse is almost negligible but for the nonsurgical cases which include the great majority of deliveries, practical nursing is more frequent; in the three lowest income groups practical nursing cases constitute more than half of the total private nursing cases.

The bars for all nursing in Figure 2 are hatched in a way to show visiting nursing as a separate category. Visiting nurse case rates are much smaller for surgical than nonsurgical cases. In the proportion of cases attended, however, surgical cases have higher percentages in four of the five income groups. In all instances for both surgical and nonsurgical cases, visiting nursing is definitely higher in the lower income groups.

It was seen above that for all cases (surgical plus nonsurgical) rates for nurse of any kind and the percentage of cases with a nurse of any kind were greater in the highest and lowest income groups than in intervening classes. However, surgical nursing cases per 1,000 population for nurse of any kind increase rather consistently with income; since most of the nursing on surgical cases is done by private nurses, the small addition of visiting nursing leaves the picture largely the same as the private nursing situation. In terms of the proportion of cases that had a nurse, however, the under \$1,200 income group had a higher percentage than the two groups with \$1,200 to \$3,000 annual income.¹⁸

¹⁸ Tabulations were also made of illnesses because of which maids and other servants were employed by the family. Among persons under 20 years old, the number of illnesses per 1,000 population of those ages because of which "other help" was employed increased from 0.6 in the under \$1,200 class to 4.9 in the \$5,000 and over group. The percentage of illnesses on account of which "other help" was employed also increased consistently with income. For the ages 20-44 years the trend was just as definite but in the opposite direction; rates per 1,000 for illnesses with "other help" decreased consistently from 27.9 for the under \$1,200 group to 10.8 for the \$5,000 and over class. This represented a regular decrease in the percentage of disabling illnesses with "other help" from 6.3 in the lowest

(Continued on page 202)

Table 3. Nursing service for all causes of illness in cities of different cities and in rural areas—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

SIZE OF CITY AND KIND OF NURSE	ALL AGES ¹			AGE									
	Number of Cases or Days		Non- surgical	Adjusted ² Rate			Under 20		20-44		45 and Over		
	Surgical	Total		Surgical	Non- surgical	Surgical	Non- surgical	Surgical	Non- surgical	Surgical	Non- surgical		
NURSING CASES PER 1,000 POPULATION DURING YEAR													
<i>Private Duty³</i> Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	163	101	27.2	12.4	14.8	7.0	8.5	15.0	16.4	14.4	20.4		
	116	166	33.7	13.5	20.2	9.6	9.0	13.6	25.8	16.2	25.4		
	43	116	23.8	6.2	17.6	2.9	5.0	9.7	29.4	6.1	10.5		
	41	65	17.8	6.5	11.3	4.2	2.8	5.7	20.4	11.5	9.9		
<i>Visiting</i> Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	51	384	20.1	3.4	25.7	2.6	24.2	4.5	31.6	4.2	23.2		
	40	299	33.7	3.0	29.8	4.5	29.3	4.6	39.4	1.5	14.6		
	23	228	32.3	2.9	29.4	4.2	26.5	2.7	43.3	—	12.2		
	5	162	24.8	.7	24.1	1.1	24.5	.5	31.3	—	7.4		
<i>Nurse of Any Kind</i> Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	202	547	53.0	14.7	38.3	9.3	32.3	18.4	44.8	16.7	40.4		
	148	448	63.8	16.4	47.4	14.1	38.0	16.2	61.2	16.9	38.5		
	65	316	51.8	9.1	42.7	7.1	30.7	12.0	64.2	6.1	26.1		
	46	217	41.0	7.2	33.8	5.3	27.1	6.2	47.4	11.5	17.3		
PERCENTAGE OF ALL CASES ⁴ THAT HAD NURSE OF SPECIFIED KIND													
<i>Private Duty³</i> Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	1,014	10,482	3.1	16.1	1.8	8.9	1.1	22.0	2.6	27.2	2.8		
	665	8,049	3.2	17.4	2.1	12.4	1.0	21.0	3.3	35.6	3.2		
	428	6,671	2.2	10.0	1.7	4.6	.5	17.0	3.6	15.9	1.9		
	332	5,022	2.0	12.4	1.3	8.2	.4	11.7	3.1	30.4	1.3		
<i>Visiting</i> Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	1,014	10,482	3.8	5.0	3.7	3.3	3.0	6.6	4.9	7.9	3.1		
	665	8,049	3.9	6.0	3.7	5.8	3.3	7.1	5.0	3.4	1.9		
	428	6,671	3.5	5.4	3.4	6.8	2.8	4.8	5.3	—	1.4		
	332	5,022	3.1	1.5	3.3	2.2	3.2	1.0	4.7	—	1.0		
<i>Nurse of Any Kind</i> Cities of 100,000 or Over	1,014	10,482	6.5	19.9	8.2	11.8	4.0	27.1	7.0	31.6	8.8		

			PERCENTAGE OF DISABLING CASES ⁴ THAT HAD NURSE OF SPECIFIED KIND										
Private Duty ³	Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	1,014 665 428 332	6,201 4,759 3,904 2,861	5.0	18.7	3.1	10.6	1.6	24.5	4.7	33.7	5.5	
				5.3	21.6	3.5	15.5	1.6	25.5	5.7	45.7	6.5	
				3.7	11.9	3.0	5.7	.9	18.9	6.5	19.4	3.9	
				3.4	14.0	2.3	9.3	.6	12.9	5.7	37.8	2.6	
Visiting	Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	872 537 362 292	6,201 4,759 3,904 2,861	5.2	5.6	5.2	3.7	3.4	7.1	8.5	9.8	4.9	
				5.4	6.9	5.2	6.3	4.2	8.7	7.8	4.3	2.6	
				4.6	5.8	4.5	8.2	3.0	3.8	8.2	—	1.8	
				4.1	1.7	4.3	2.5	3.5	1.1	8.0	—	1.3	
Nurse of Any Kind	Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas	872 537 362 292	6,201 4,759 3,904 2,861	9.6	22.9	7.8	13.8	4.9	39.8	12.2	39.1	9.3	
				10.1	27.0	8.2	21.8	5.8	30.4	12.5	47.8	7.9	
				7.6	17.4	6.7	13.9	3.8	22.0	12.8	19.4	5.1	
				7.1	15.7	6.3	11.8	4.1	14.0	12.5	37.8	3.9	
POPULATION (YEARS OF LIFE)													
Cities of 100,000 or Over Cities 5,000-100,000 Towns Under 5,000 Rural Areas				14.351	6.572	5.540	2.155						
				9.694	4.916	3.449	1.298						
				7.585	3.812	2.589	1.151						
				6.914	3.546	2.111	1.218						

¹ All ages includes a few of unknown age.

² All rates per 1,000 population of all ages are adjusted by the *indirect* method to the age distribution of the white population of the registration States in 1930. Briefly this method involves the following steps: age specific rates like those in Table 1 of a preceding paper (20) for the whole canvassed population are used as "standard rates" and multiplied by the canvassed population of specific ages for a given subgroup (for example, cities over 100,000) to obtain expected numbers of cases for the computation of an expected rate for all ages; when this rate is related to the corresponding adjusted rate for the whole canvassed group (adjustment there was by direct method), one obtains an "adjustment factor," which is of the nature of a percentage correction for differences in age distribution. This adjustment or correction factor is applied to the crude rate of the subgroup to obtain the adjusted rate. The details of the method are given under the heading "standardized death rates" in Pearl (33, pp. 205-269).

³ Percentages of cases are not adjusted in any way.
⁴ Private duty includes full-time graduate or practical *private* nurse in or outside of a hospital except six cases in resident institutions. Days of private duty nursing on all types of cases per 1,000 population (age adjusted) were: cities 100,000 or over, 534; cities 5,000-100,000, 517; towns under 5,000, 363; and rural areas, 194. These nursing day rates exclude eight cases with 252 or more nursing days (shifts) during the study year. For further details, see text footnote 10.

⁵ All cases include those with symptoms lasting one day or longer (disabling and nondisabling). Disabling cases refer to those causing inability to work, attend school, care for the home, or pursue other usual activities for one day or longer, regardless of age or employment status. All private duty nursing was on disabling cases, but a considerable amount of visiting nursing was on nondisabling cases.

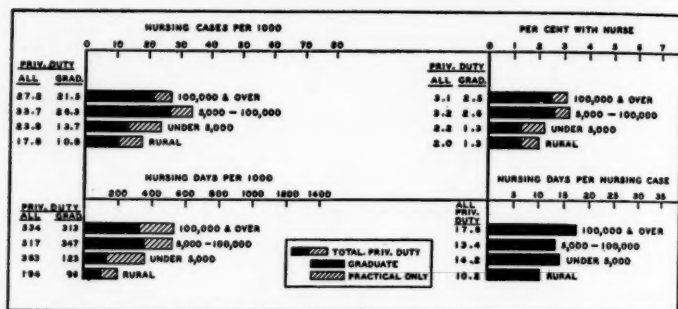


Fig. 3. Annual frequency of graduate and practical private nursing cases and days among persons of all ages in cities of different sizes and in rural areas—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931 (age adjusted rates per 1,000 population and percentages of all cases that had a nurse.)

Size of City. Figure 3 shows data on private nursing in rural areas and in cities of different sizes (Table 3). Although these nursing rates tend to be higher in the cities the differences are so much smaller than those between income groups that they seem insignificant. For example, private nursing case rates per 1,000 population for cities are only about one and a half to two times those for rural unincorporated areas; the same is true of the percentage of all cases that had a private nurse. Nevertheless these relative excesses in nursing rates in cities over those for rural areas approximate those found for hospitalization in a preceding paper (19), but the increase with size of city is not as consistent. The finding of less private nursing in cities over 100,000 than in smaller cities may be related to the high hospital rates in these large cities, for hospital service may take the place of private nursing care.³⁴

to 2.4 in the highest income group. Thus at the ages of the active housewife, "other help" was more frequently obtained in the low-income levels where there were more young children to be cared for and fewer regular servants to do the work; in some families "other help" may have been a substitute for a nurse. In the ages above 45 years, the trend is like that under 20 years—toward more "other help" in the higher income levels, but the changes with income were less consistent.

In the urban-rural picture, there was some tendency toward more "other help" in cities than in rural areas but the differences were not consistent.

³⁴ Considering all localities together, the number of cases with a private nurse in or outside of a hospital was only about half the number of cases in a hospital without a private

(Continued on page 203)

	PERCENTAGE DONE BY GRADUATE NURSE						TOTAL NUMBER OF CASES WITH PRIVATE NURSE	
	PRIVATE NURSING CASES				NURSING DAYS			
	All Causes			Deliveries and Abortions	All Causes	Deliveries and Abortions	All Causes	Deliveries and Abortions
	Total	Surgical	Non-surgical					
Urban ¹	80	98	67	55	68	54	636	130
Rural	61	96	44	27	42	15	265	96

¹ Urban includes cities of 5,000 or more population; rural includes towns under 5,000 and rural areas.

Table 4. Percentage of private duty nursing that was done by graduate nurses among canvassed white urban and rural families during twelve consecutive months, 1928-1931.

In small towns and rural areas a considerable proportion of the private duty nursing was done by practical nurses (Table 4). Of all private nursing cases in cities of 5,000 or over, 80 per cent had a graduate nurse, as compared with 61 per cent for towns and rural areas.²⁵ Of all private nursing days in cities over 5,000, 68 per cent were graduate days as compared with 42 per cent for small towns and rural areas. In both urban and rural areas, nearly all surgical cases with a private nurse were graduate cases. However, in nursing on nonsurgical cases and particularly on delivery, which represents the most important diagnosis in private nursing, large urban-rural differences appear. In urban places 55 per cent of the nursing

nurse, but with the usual services of the general duty hospital nurse. Data in the following table of nursing case rates and percentages are *exclusive of the services of visiting nurses*.

	Cities of 100,000 or Over	Cities 5,000- 100,000	Towns Under 5,000	Rural Areas
<i>Nursing Cases per 1,000 Population (Crude):</i>				
Private Nurse In or Outside of Hospital	24.7	29.1	21.0	15.3
General Duty Hospital Nurse Only	55.5	50.3	42.7	35.1
Private Nurse or General Duty Hospital Nurse	80.2	79.4	63.7	50.4
<i>Per Cent of Disabling Cases with Nurse:</i>				
Private Nurse In or Outside of Hospital	5.0	5.3	3.7	3.4
General Duty Hospital Nurse Only	11.3	9.2	7.6	7.7
Private Nurse or General Duty Hospital Nurse	16.3	14.5	11.3	11.1

²⁵ In the urban group the percentages for large and small cities were roughly the same and in the rural group those for small towns and rural areas also approximated each other.

cases on deliveries had a graduate nurse, as compared with 27 per cent in rural areas; corresponding percentages for deliveries for private nursing days that were graduate were 54 for urban and 15 per cent for rural areas.

Private nursing rates per 1,000 population for surgical cases in cities were about twice what they were in small towns and rural areas (Table 3). Nursing rates for nonsurgical cases, however, do not show any very consistent trend with size of city, although there is a tendency toward more nursing in cities than in rural unincorporated areas.

Likewise, visiting nursing does not show consistent urban-rural variation, although there is a tendency toward lower rates in rural areas, particularly for surgical cases. Family income seems to be a far more important factor in nursing care than the urban-rural situation; however, it should be noted that all or practically all of the rural areas and small towns included in this study had a visiting nurse and usually a county health department, so they do not represent the most rural sections with no health services.

Table 5 shows nursing rates for all illnesses for two broad urban-rural categories in four geographic sections. Rates and percentages for private duty and for any nurse are nearly all higher for urban than for rural areas, but visiting nursing shows less consistent differences.

Family Income and Size of City. Table 6 shows nursing case rates for five income groups in metropolitan, urban, and rural areas separately. A regular increase with income occurs in private nursing in each of the three city-sizes except for the highest income in rural areas. In surgical cases even the rural category shows a regular increase with income. Comparison of the three city-size categories for given income levels does not show consistent variation with size of city. In the three income groups from \$1,200 to \$5,000, private nursing case rates for all and for nonsurgical cases increase slightly but rather consistently as size of city decreases. Visiting nursing, on

Table 5. Nursing service for all causes of illness among persons of all ages in urban¹ and rural parts of four geographic² sections—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

URBAN-RURAL STATUS AND TYPE OF NURSE	ALL SEC- TIONS	NORTH- EAST	NORTH- CEN- TRAL	SOUTH	WEST	ALL SEC- TIONS	NORTH- EAST	NORTH- CEN- TRAL	SOUTH	WEST
	NURSING CASES OF SPECIFIED KIND PER 1,000 POPULATION DURING YEAR (AGE ADJUSTED) ³					PERCENTAGE OF DISABLING ⁴ CASES THAT HAD A NURSE OF SPECIFIED KIND				
PRIVATE DUTY⁵ NURSE										
Total										
Urban ¹	29.8	42.5	20.1	30.0	39.7	5.1	6.6	3.9	4.5	6.8
Rural	21.0	27.2	14.7	16.0	23.4	3.6	5.2	2.5	3.9	3.5
<i>Surgical</i>										
Urban ¹	12.9	17.7	9.4	11.8	17.2	19.8	30.6	15.3	15.5	24.7
Rural	6.3	7.5	5.1	5.1	7.2	12.8	16.5	9.8	14.0	11.7
<i>Nonsurgical</i>										
Urban ¹	16.9	24.8	10.7	18.2	22.5	3.3	4.1	2.4	3.1	4.4
Rural	14.7	19.7	9.6	10.9	16.2	2.7	4.1	1.7	2.0	2.6
VISITING NURSE										
Urban ¹	31.0	41.2	23.9	46.0	18.8	5.3	5.5	5.0	7.3	3.0
Rural	28.8	31.5	24.0	14.7	42.0	4.4	5.2	3.6	2.6	5.4
NURSE OF ANY KIND										
Urban ¹	57.3	79.8	41.7	70.6	56.6	9.8	11.5	8.5	10.8	9.5
Rural	46.8	52.9	37.4	28.2	64.1	7.4	9.3	5.8	5.1	8.5
	ANNUAL NURSING DAYS (SHIFTS) PER 1,000 POPULATION (AGE ADJUSTED) ³					NURSING DAYS (SHIFTS) PER NURSING CASE				
PRIVATE DUTY⁵ NURSE										
Urban ¹	527	773	343	567	649	15.8	16.2	14.8	16.3	16.0
Rural	282	452	143	172	275	12.6	16.8	8.6	9.6	10.6
	POPULATION (YEARS OF LIFE)					TOTAL NUMBER OF DISABLING ⁴ CASES				
Urban ¹	24,045	4,762	10,502	4,914	3,867	12,379	2,645	4,748	2,842	2,144
Rural	14,490	4,281	3,911	2,827	3,480	7,419	2,095	1,954	1,325	2,045

¹ Urban includes cities of 5,000 or more population; rural includes towns under 5,000 and rural areas.

² States included in the survey were as follows: *Northeast*—New York, Massachusetts, Connecticut. *North Central*—Illinois, Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas. *South*—District of Columbia, Virginia, West Virginia, Tennessee, Georgia. *West*—Washington, California, Colorado.

³ All rates per 1,000 population are adjusted by the *indirect* method as described in note 2 to Table 3. Days per case and percentages of cases are not adjusted in any way.

⁴ Disabling cases refer to those causing inability to work, attend school, care for the home, or pursue other usual activities for one day or longer, regardless of age or employment status.

⁵ Private duty includes full-time graduate or practical *private* nurse in or outside of a hospital except six cases in resident institutions. Rates and averages involving nursing days also exclude eight cases with 252 or more nursing days (shifts) during the study year. For further details, see text footnote 10.

Table 6. Nursing service for all causes of illness among persons of all ages in families of various income levels in cities of different sizes—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

ANNUAL FAMILY INCOME AND KIND OF NURSE	CITIES OF 100,000 OR OVER		CITIES 5,000- 100,000	TOWNS UNDER 5,000 AND RURAL	CITIES OF 100,000 OR OVER	CITIES 5,000- 100,000	TOWNS UNDER 5,000 AND RURAL	CITIES OF 100,000 OR OVER	CITIES 5,000- 100,000	TOWNS UNDER 5,000 AND RURAL
	NURSING CASES PER 1,000 POPULATION DURING YEAR (AGE ADJUSTED) ¹			PERCENTAGE OF ALL CASES ² THAT HAD NURSE OF SPECIFIED KIND			NUMBER OF NURSING CASES OF SPECIFIED KIND			
PRIVATE DUTY ³										
Total Cases										
Under \$1,200	11.1	7.0	10.7	1.2	.8	1.2	8	7	36	
\$1,200 but Under \$2,000	12.1	17.2	20.9	1.5	1.7	2.2	50	42	106	
\$2,000 but Under \$3,000	18.2	24.0	26.9	2.2	2.5	2.6	67	53	66	
\$3,000 but Under \$5,000	28.0	31.3	34.5	3.3	2.9	3.3	62	36	39	
\$5,000 and Over	72.3	87.2	31.9	6.8	7.7	2.7	165	141	14	
Surgical Cases										
Under \$1,200	5.5	.9	2.5	7.1	1.3	5.5	4	1	9	
\$1,200 but Under \$2,000	5.8	4.9	6.2	8.6	7.2	11.5	24	12	33	
\$2,000 but Under \$3,000	8.8	8.5	6.7	11.0	11.4	9.8	33	19	18	
\$3,000 but Under \$5,000	14.8	8.9	13.6	23.2	12.1	19.8	33	11	16	
\$5,000 and Over	28.9	41.1	15.2	29.1	45.8	24.1	68	70	7	
Nonsurgical Cases										
Under \$1,200	5.6	6.1	8.2	.7	.7	.9	4	6	27	
\$1,200 but Under \$2,000	6.3	12.3	14.7	.8	1.3	1.6	26	30	73	
\$2,000 but Under \$3,000	9.4	15.5	20.2	1.2	1.7	2.0	34	34	48	
\$3,000 but Under \$5,000	13.2	22.4	20.9	1.7	2.2	2.1	29	25	23	
\$5,000 and Over	43.4	46.1	16.7	4.5	4.3	1.4	97	71	7	
VISITING NURSE										
Under \$1,200	51.0	97.3	35.2	6.2	14.0	4.5	40	129	135	
\$1,200 but Under \$2,000	37.2	36.1	32.5	5.6	4.6	4.0	189	114	194	
\$2,000 but Under \$3,000	28.5	20.2	21.9	4.0	2.5	2.4	124	54	61	
\$3,000 but Under \$5,000	18.0	14.6	11.3	2.3	1.6	1.2	43	19	14	
\$5,000 and Over	15.4	9.2	8.6	1.5	.8	.8	36	15	4	
NURSE OF ANY KIND										
Under \$1,200	62.1	104.3	45.2	7.4	14.6	5.5	48	135	165	
\$1,200 but Under \$2,000	49.3	50.9	49.9	6.9	5.9	5.8	233	145	280	
\$2,000 but Under \$3,000	43.3	39.2	44.1	5.7	4.5	4.5	176	97	117	
\$3,000 but Under \$5,000	40.2	45.9	42.6	5.0	4.5	4.3	93	55	51	
\$5,000 and Over	84.2	93.7	40.5	8.1	8.4	3.5	195	153	18	
	ANNUAL DAYS (SHIFTS) OF PRIVATE DUTY NURS- ING ³ PER 1,000 POPULA- TION (AGE ADJUSTED) ¹			NURSING DAYS (SHIFTS) PER PRIVATE DUTY NURSING CASE ²			POPULATION (YEARS OF LIFE)			
Under \$1,200	179	68	101	16.3	8.0	9.0	772	1,236	3,812	
\$1,200 but Under \$2,000	167	191	321	11.8	9.1	13.9	4,675	2,873	5,871	
\$2,000 but Under \$3,000	308	246	321	14.6	8.9	10.9	4,166	2,490	2,835	
\$3,000 but Under \$5,000	446	450	511	15.0	12.9	14.5	2,334	1,314	1,263	
\$5,000 and Over	1,580	1,497	508	21.0	17.1	16.4	2,389	1,805	495	

¹ All rates per 1,000 population are adjusted by the *indirect* method as described in note 2 to Table 3. Days per case and percentages of cases are not adjusted in any way.

² All cases include those with symptoms lasting one day or longer (disabling and nondisabling).

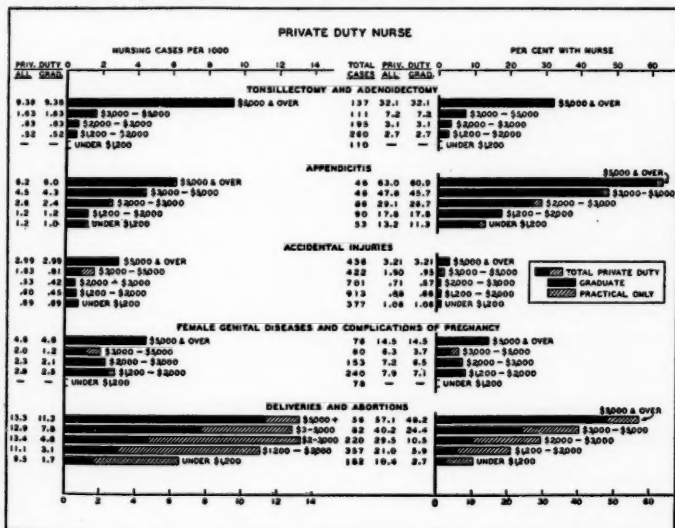
³ Private duty includes full-time graduate or practical *private* nurse in or outside of a hospital except six cases in resident institutions. Rates and averages involving nursing days also exclude eight cases with 252 or more nursing days (shifts) during the study year. For further details, see text footnote 10.

the other hand, shows some tendency to increase with size of city among families of given income levels. With respect to variation with income, visiting nursing rates are consistently larger for the lower income groups in each city-size category. When all types of nursing are considered together there are no striking variations with income in the rural group, but in the two city categories the low and high income levels have higher rates than the intervening classes.¹⁸

NURSING FOR ILLNESS FROM IMPORTANT DIAGNOSES

Figure 4 shows by income for five diagnoses that are important in nursing care (a) private duty nursing cases per 1,000 population,

Fig. 4. Annual frequency of graduate and practical private nursing cases for certain diagnoses among persons of all ages in families of different income levels in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary causes only. Rates for deliveries and female genital diseases are expressed as per 1,000 females; percentages of all cases that had a nurse.)



¹⁸ Data on the percentage of families having expenditures for private nursing care are given by detailed incomes and for five urban-rural categories by Klem (22).

and (b) percentage of cases attended by a private nurse. Deliveries with any private nurse per 1,000 females increase with income only up to \$3,000, but those with a graduate nurse increase regularly throughout the income range. However, the percentage of deliveries attended by any private nurse and by a graduate nurse both show large and consistent increases with income. In the three lowest income groups, roughly two-thirds to three-fourths of the private nurses on maternity cases were practical nurses, as compared with one-sixth in the highest income group.

All of the private nursing on tonsillectomies and nearly all of that on appendicitis cases was graduate. For both diagnoses, private duty nursing increased definitely with income; there were no cases with a private nurse among 110 tonsillectomies in the under \$1,200 income class, but in the \$5,000 and over group, nearly one-third of the tonsillectomy cases had a private nurse. Accidents and female genital diseases³⁷ tended toward higher private nursing rates in the higher income levels, but the increases were not consistent.

In Figure 5 visiting nursing case rates and percentages are shown as a subgroup of all nursing. Tonsillectomy and delivery (including pre and postnatal care) show definitely more visiting nursing in the lower income levels, and accidents show a tendency in the same direction. Visiting nursing for appendicitis and female genital diseases shows no consistent relationship to income.

Deliveries with a nurse of any kind (including pre and postnatal visits) per 1,000 females increase as income decreases (Figure 5). In percentages of cases with a nurse of any kind there is no large variation with income, but the \$2,000 to \$5,000 income levels have somewhat smaller percentages than the lowest and highest levels. Appendicitis shows a definite increase with income and female genital diseases show the same tendency. The other two diagnoses, tonsillectomy and accidents, show more nursing in the high and

³⁷ Throughout this paper benign tumors of the female genital organs and breast and other diseases of the female breast are included in the group of female genital diseases.

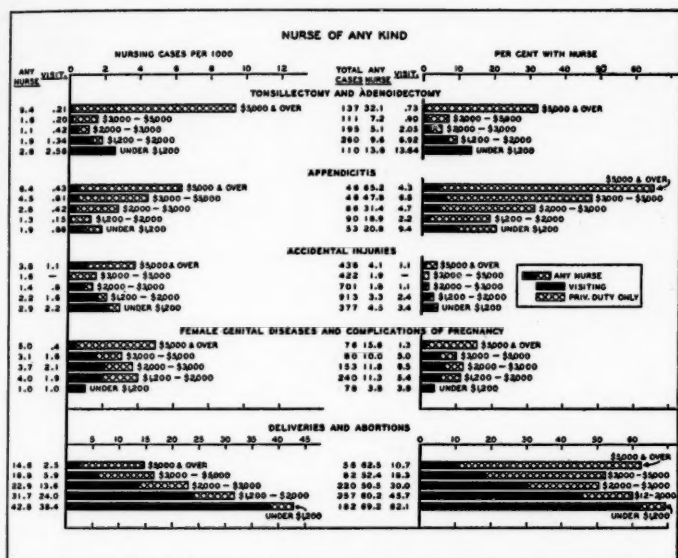


Fig. 5. Annual frequency of visiting and of all nursing for certain diagnoses among persons of all ages in families of different income levels in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary causes only. Rates for deliveries and female genital diseases are expressed as per 1,000 females; percentages of all cases that had a nurse.)

low-income levels than in intermediate groups. It must be remembered in this connection that nursing in the lower income levels consists largely of visits while that in the higher levels consists largely of full-time care, usually by a graduate nurse.

Table 7 is arranged to compare nursing in urban and rural areas for the same five diagnoses. Although the differences are small, nursing cases per 1,000 population and the percentage of cases with a nurse are consistently less in rural areas for tonsillectomy, appendicitis, and accidents for a nurse of any kind and for a graduate nurse. A nurse of any kind for deliveries is about the same in urban and rural areas, but graduate nursing is higher in urban and practical nursing is higher in rural areas.

KIND OF NURSE	TONSILLECTOMY AND ADENOIDECTOMY		APPENDICITIS		ACCIDENTAL INJURIES		DELIVERIES AND ABORTIONS ³		FEMALE GENI- TAL DISEASES AND PREGNANCY COMPLICATIONS ⁴	
	Urban ¹	Rural	Urban ¹	Rural	Urban ¹	Rural	Urban ¹	Rural	Urban ¹	Rural
NURSING CASES ² PER 1,000 POPULATION DURING YEAR										
Private Duty ²	2.45	.62	2.91	1.66	.91	.69	5.75	3.57	2.03	2.20
Graduate	—	—	.13	.13	.17	.21	4.78	9.61	.08	.55
Practical Only	.96	1.24	.50	.28	1.37	1.03	19.12	18.26	1.86	1.10
Visiting	3.33	1.86	3.24	2.00	2.41	1.93	27.14	27.74	3.48	3.43
Nurse of Any Kind										
PERCENTAGE OF ALL CASES ⁴ THAT HAD A NURSE OF SPECIFIED KIND										
Private Duty ²	10.3	3.5	34.0	20.5	1.2	.9	12.4	7.8	6.3	6.8
Graduate	—	—	1.5	1.7	.2	.3	10.3	20.9	.3	1.7
Practical Only	4.0	7.1	5.8	3.4	1.9	1.4	41.3	39.7	5.8	3.4
Visiting	14.0	10.6	37.9	24.8	3.3	2.6	58.7	60.3	10.8	10.5
Nurse of Any Kind										
PERCENTAGE OF PRIVATE DUTY ² NURSING CASES THAT HAD A GRADUATE NURSE										
Graduate Nurse	100	100	96	92	85	77	55	27	96	80
NUMBER OF NURSING CASES OF THE SPECIFIED KIND										
Private Duty ²	59	9	70	24	22	10	71	26	25	16
Graduate	—	—	3	2	4	3	59	70	1	4
Practical Only	23	18	12	4	33	15	236	133	23	8
Visiting	80	27	78	29	58	28	335	202	43	25
Nurse of Any Kind										

¹ Urban includes cities of 5,000 or more population; rural includes towns under 5,000 and rural areas.

² Case rates for deliveries and female genital diseases are computed as per 1,000 females. Rates are not adjusted for age differences.

³ Private duty includes full-time graduate or practical *private* nurse in or outside of a hospital.

⁴ All cases include those with symptoms lasting one day or longer (disabling and non-disabling).

Table 7. Nursing service in connection with cases of certain diagnoses in urban¹ and rural areas—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses only.)

SUMMARY

Data on the frequency of illness and nursing care were recorded for a twelve-month period between 1928 and 1931 by periodic canvasses of 8,758 white families in 130 localities in eighteen States.

The surveyed families include representation from nearly all geographic sections, from rural, urban, and metropolitan areas, from all income classes and of both native and foreign-born persons. Visits were made at intervals of two to four months. Illnesses causing symptoms for one day or longer were recorded, together with the number of cases with a private duty or visiting nurse and the days and visits within the study year.

Private nursing service showed greater concentration in the higher income levels than any other type of medical care except certain types of dental service. Nursing cases and days per 1,000 population and the percentage of cases with a private nurse all showed large excesses in the higher income levels. The percentages of both cases and days of private nursing that were done by practical nurses were definitely higher in the low-income groups, particularly for maternity cases.

Visiting nursing showed a high concentration in the low-income levels. Nursing of any kind (private or visiting) therefore showed greater frequency in high and low-income groups than in the middle-income levels.

Urban areas showed some excess over rural areas in nursing service. Urban-rural variation in nursing service was of the same order of magnitude as the same type of variation in hospital care, but was somewhat less consistent; income differences in nursing care were much greater than urban-rural variation, but the opposite was true of hospital care.

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ANNOTATIONS

PROFESSIONAL DENTISTRY IN AMERICAN SOCIETY¹

THE importance of dental health to physical welfare has not been recognized to the extent that it should be by individual members of society, by the medical and public health professions, by planners of social legislation, and by the dentists themselves in the opinion of Dr. Alfred J. Asgis. In his book, *PROFESSIONAL DENTISTRY IN AMERICAN SOCIETY*, Dr. Asgis reviews the present status of dentistry, its relation to other health agencies, and the effect on it of socio-economic factors in our national life; discusses educational methods and the need to give students a better understanding of professional dentistry as a public service; and advocates social dental programs which would make it possible for dentistry to function better as a public health service. This book should be of interest not only to members of the dental profession but to all public health and lay persons who are concerned with improving dental health conditions.

The failure of the individual citizen to obtain necessary dental care is well demonstrated by the large number of young men rejected for military service because of dental defects. This failure presents both educational and economic problems, and Dr. Asgis says "it seems that the solution for increased consumption of dental services lies in *some* group method of distribution." Since, in dentistry, "prevention is confined largely to methods of *control*," that is, to early treatment of dental caries and oral diseases, Dr. Asgis recommends that "at least one-third of each medical dollar available for medical and other health services under any form of health insurance should be made available specifically for dentistry." The basis for this proportion is not given. It is also urged that dental service be recognized as a proper and important part of public

¹ *PROFESSIONAL DENTISTRY IN AMERICAN SOCIETY*. Alfred J. Asgis, Ph.D., D.D.S. New York, Clinical Press, 1941.

school health programs. Dentists must recognize and accept their responsibility to dental health planning and programs, and those engaged in public health dentistry should have special graduate training in this field.

Only a small portion of the book is devoted specifically to dentistry in public health. A large share of Part One traces the history and development of dentistry from a skilled or technical vocation one hundred years ago to its present status of a professional specialty. Dental education has been the keystone of progress and the methods and curricula of dental education, past, present, and future, are fully discussed by Dr. Asgis with emphasis on their relation to the ethical, scientific, and social standards of the profession. In Part Two, included only in the limited edition, the author reviews the findings of a teacher education study which he conducted in 1939 and suggests "an approach to a program of educating dentists and teachers of dentistry in line with the aims of functional dental education."

DOROTHY G. WIEHL